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MAN'S BLOOD COUSIN—THE GORILLA

Articles by

David Starr Jordan, William K. Gregory, Henshaw Ward, Albert G. Ingalls, Maynard Shipley, Horace J. Bridges, Barrow Lyons, Harry A. Overstreet

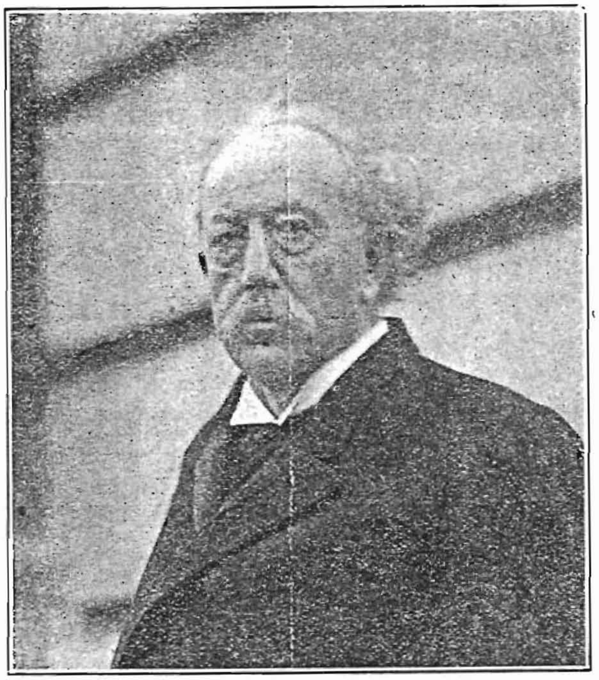
Who Believes in Evolution?

By David Starr Jordan

JUST now in America organic evolution has come to the front as a popular issue. With it is the broader question as to whether scientific teaching and scientific research shall be subject to official censorship of men who know nothing of such matters. As to the final issue there can be no doubt, for science will insist upon and secure its own freedom.

The word evolution as commonly accepted comprises two distinct conceptions, the making of the material universe and the development of life and mind on the earth. Cosmic evolution deals with the formation of worlds, moons, mountains, crystals, seas, rivers and glaciers—matter that in itself has no organic life. This bears no intimate relation to organic evolution, the development on the earth of animals and plants. It is true that all are in the same universe, from which nothing can escape. It is true that all are undergoing change, and that all such change so far as we can trace it is, in all its details, perfectly orderly.

But to unite the phenomena of life and those of inert matter as one group of phenomena is to ignore and confuse our knowledge of the essential qualities of organized life. Cosmic evolution in these days no one presumes to doubt. Its struggle with tradition is virtually past. The facts of organic evolution are equally well, though not so exhaustively, settled, but there persists a kind of guerrilla warfare against its main conclusions.



David Starr Jordan

In their relation to organic evolution, several classes may be recognized among our people. We have first a small minority comprising those who know as to the common origin of animals and plants, either through broad, critical observation of animals and plants—the naturalists—or through experiments with living beings or organisms—the geneticists. Among these there is no difference of opinion on the main question. All life is and has always been subject to orderly divergence. The animals and plants of today are descended from those of the past. All men who have a right to an opinion or are capable of forming an opinion from the evidence of nature are now evolutionists. The main facts are in, and none of them are explainable under any other supposition. The great argument in biology is the cumulative one. But as to the relative value of the factors or forces which brought it about, and as to the probable geological history of each group, there remains much difference of opinion. Such differences furnish incentives to future work.

A second class called evolutionists, often very baffling to workers themselves, are the imperfectly educated who accept evolution but are impatient with the slow progress which actual knowledge demands. They delight to run ahead of science and to anticipate it by methods of fancy, using fragments of philosophy, bits of poetry or of assumed "logical necessity." In science we can know the truth only so fast as we can find it out. Science is embarrassed by tradition and intuition alike.

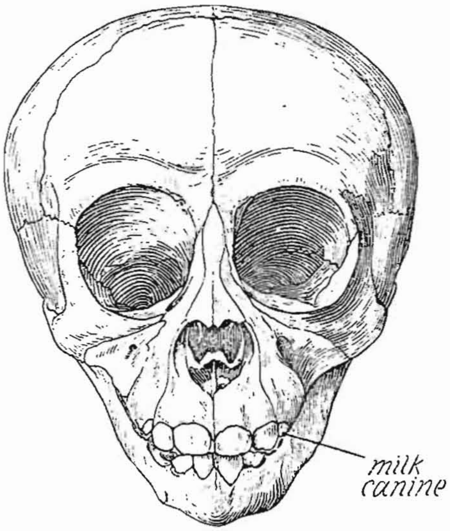
A third and much larger class realize they must acaccept most conclusions on the authority of men who have given their lives to the study of the science of life and are therefore in full agreement as to the meaning of what men have found to be true. No man can have an opinion of his own on all subjects. He must trust to authority for the most. But the mark of the educated man is that he knows what authority he can trust. To enable men to do this is a central purpose of education. To teach this conclusion or that, one set of dogmas rather than another, truth even rather than falsehood, is not a university's business. It is rather to give such training as will enable the student to find out for himself. Only by such means can any man acquire the "courage of his convictions." A working hypothesis becomes science only when rival hypotheses have definitely ceased to work. When this takes place science moves on, never returning to occupy territory once abandoned.

A fourth class are interested chiefly in evolution in so far as it seems to stand in opposition to current orthodoxy or to religion.

A fifth class, the largest of all, enjoy going with the crowd, priding themselves on their hundred per cent regularity in all matters of opinion having the backing of some form of tradition. The burden carried by *tradition* is essentially one of ignorance. It treats as final the conceptions of able men of other ages, who had neither tools of observation nor training by which to carry on experiments. These men, of whose judgment we have records, were devoted and sincere but made no claim to any form of omniscience, only reporting their own impressions in forms of history and poetry.

A sixth class rejoice in being blind leaders of the blind, scorning science and willing to use civil authority for its suppression.

(Dr. Jordan's argument will be continued in the next issue of Evolution*)*



Gorilla Baby

The Testimony of Man's Teeth

By WILLIAM K. GREGORY

THE infant gorilla that is now in the Philadelphia Zoological Park is a friendly little chap, wanting chiefly to be babied and fussed with. So it is not surprising that he let me put my finger in his mouth to feel his teeth. If he lives several years longer he should, if he is like other young gorillas, eventually have a full set of milk teeth numbering twenty in all and arranged as follows:

on either side of the upper jaw
two incisors, one canine, two "milk molars";
on either side of the lower jaw
two incisors, one canine, two "milk molars."

Is it a mere coincidence that normal human children also have twenty milk teeth? And that they also have,

on either side of the upper jaw
two incisors, one canine, two "milk molars";
and on either side of the lower jaw
two incisors, one canine, two "milk molars"?

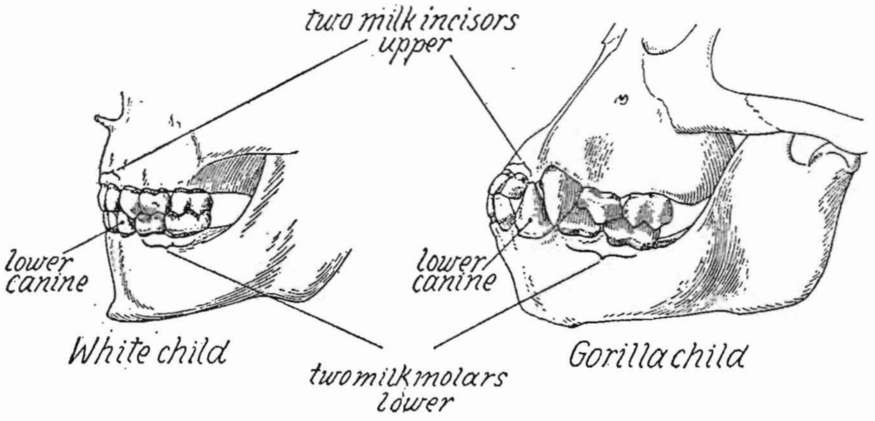
And is it a further coincidence that when gorilla and human children grow up they should as a rule have thirty-two teeth in the adult set, arranged as follows:

on either side of the upper jaw
two incisors, one canine, two premolars, three molars;
and on either side of the lower jaw
two incisors, one canine, two premolars, three molars?

And is it not significant that these particular numbers and arrangements of the milk and adult teeth in all the class of mammals are found only in the higher or Old World monkeys, apes and man? Is man made literally in the image of God in this respect also? Or did he inherit his normal "dental formula" from some far-off members of the ancestral stock of the anthropoid apes, as Darwin inferred?

Let us follow this line further. How many principal points or cusps has the reader got on his second right or left lower molar? If he is like most people he will find only four cusps, separated from each other at their bases by two main grooves forming a cross. This is a distinctly human arrangement and taken by itself is a conspicuous point of difference from the corresponding tooth of all the known apes, living and fossil, which have normally five cusps on the second lower molar.

But about one-fourth of white people have a fifth cusp on the first lower molar and a good many negroes, black Australians and other primitive individuals have five cusps on all three lower molars. And as there are hundreds of jaws in which the fifth or hinder cusp has almost disappeared, so there are other jaws in which it is less and less reduced. In the most ancient fossil human jaws known, namely the Heidelberg jaw, the



Mousterian jaw and the Ehringsdorf jaw, there are five main cusps on all three lower molars.

Is it another coincidence that each of the three lower molars of all the known anthropoid apes also bears five main cusps? And is it also by chance that in all known apes and many men these cusps are separated at their bases by six main grooves, each of which obviously corresponds in position in apes and men? Thus if the reader wears the sign of the cross on his second lower molar, the chances are that his first lower molar is impressed with the mark of the ape, and certain it is that the oldest known fossil human lower molars are the ones that most closely approach the "Dryopithecus pattern" of the primitive ape molar.

We do not yet know the direct ancestors of man as well as we know the direct ancestors of the horse, but what little we do know of fossil men and fossil apes is fully in accord with the vast mass of testimony already gathered by the students of human and comparative anatomy and physiology. Their verdict has long been that man is a blood cousin to the ape. What scientific evidence is there to the contrary?

Bamboo

NO BABY animal in America today is attracting more attention from men of science than fourteen-months-old Bamboo, the infant gorilla in the Philadelphia Zoo. He is the most human animal infant in captivity for his ways are decidedly like those of a normal baby of our own species.

Bamboo

That should not be the least surprising, for he is in fact a blood cousin, very distantly removed, but nevertheless from the same ancestral stock as homo sapiens—modern civilized man. Way, way back some four or five million years ago, there lived an old fellow and his wife whom scientists now call Mr. and Mrs. Dryopithecus. In all probability Dryopithecus was the common ancestor of the modern man-like apes and human beings.

Probably his children crawled and cried much like our own little ones and much like baby Bamboo in the Philadelphia Zoo, for those who have watched him say his movements are astonishingly childlike; and when he is put down he cries to be taken up again in just about the same tones we have all heard voiced by babies in our own homes.

But there are few human babies who have travelled as far as Bamboo. One warm morning last spring Bamboo's mother took her sprawling infant out for an airing in the mountainous Cameroon district of German East Africa. He was then a squat, black, awkward little fellow who clung timorously to his mother's great hands—as he still is. A native scuttling through the jungle nearly bumped into Bamboo's mother and forthwith she dropped her child and started to make life lively for the native. The man drew a poisoned arrow to save his life and sunk it deeply in her chest. He scooped up Bamboo and took him to a missionary camp.

Natives who crated Bamboo for his trip overseas knew enough about baby gorillas to realize that he would not eat unless he had a less sensitive companion, so Lizzie, ten months old, but of a motherly nature, though of Chimpanzee stock, was put in the cage with him to keep him from dying of homesickness and loneliness, and stimulate his appetite.

When Bamboo arrived at Henry Bartel's animal place in New York he proved so charming a host that many of his callers could not be prevailed upon to leave for more than two hours. Newspaper men and photographers soon succeeded in making him one of America's most distinguished guests.

It was then that the young gorilla child became known as little Bimbo—not Bamboo, as the dignified Philadelphia Zoo later decided to re-christen him. His companion, Lizzie, also became well known, but most of the charm seemed to be with the gorilla personality. Professor Robert Mearns Yerkes of Yale University wanted to take Bimbo with him to Yale for observation and study, but Mr. Bartels wanted $5,000 for the privilege. So finally Bimbo—or rather Bamboo — went to the Quaker City.

It has proved very difficult to raise gorilla children in the United States, but thus far Bamboo seems to be doing nicely, thank you.

If Bamboo lives, we can expect him to teach us a great many extremely interesting things that a human child would not teach. Human children have been closely observed for quite some time, but gorilla children have furnished very little laboratory material to psychologists and biologists. Throughout the progress of his childhood he will be closely watched by those most interested in the genealogy of their race—and Bamboo's.

RADIOACTIVITY IN THE HEART

DR. H. Zwaardemaker of the University of Utrecht, a distinguished Dutch physiologist, has discovered that the heart muscle removed from an animal can be kept in motion by rays from radium and other radioactive substances. A common element, potassium, is believed to be slightly radioactive and is known to exist in the blood and in the heart muscles.

From this Dr. Zwaardemaker deduces that the living heart is kept in motion partly by the radioactivity of potassium in the body.

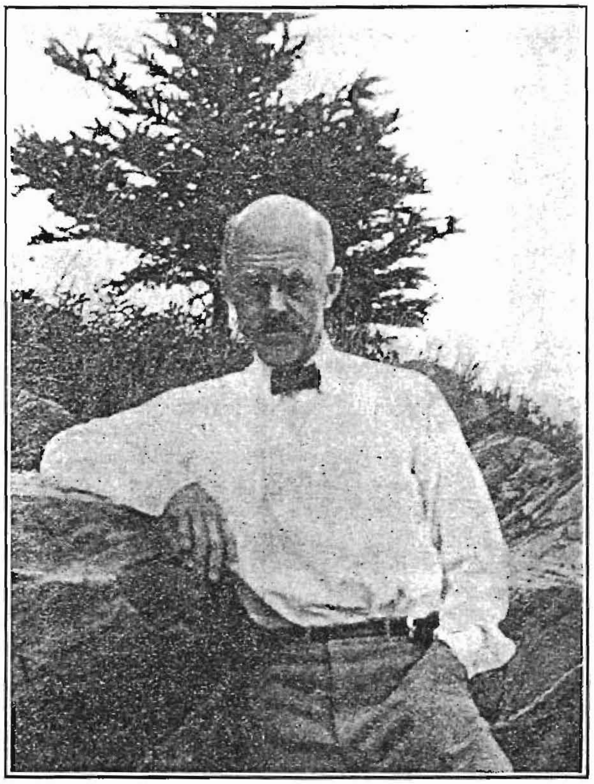
What Is Evolution?

By HENSHAW WARD

IT is astonishing to see how often "evolution" is misconceived by educated people, sometimes even by scientists. Learned journalists and professors have upheld or derided evolution without first inquiring what the theory really is. I will briefly describe how it originated, how inescapable it is, how simple and restricted it is.

Since the time of Aristotle there has been in the world a theory that in some unknown way, animals and plants have developed from previous simpler forms. This idea arose very naturally from the mere observation of the way in which the kinds of animals form a sort of series from lowly plant-like forms to quadrupeds. From the lowest plants to man there is no big gap in the scale of forms: all animate nature appears to be a sort of gradation. No wonder that Aristotle and Lucretius and Leonardo da Vinci guessed that the great array of living beings might have diverged from some primitive creatures.

But this was merely speculation. Not until the eighteenth century was there any real effort by naturalists to explain *how* such transmutation was possible. The most original and powerful of the early reasoners was Buffon, who set forth an ingenious conjecture in 1750—that changes of climate and food cause alterations in animals, and that these alterations are inherited, continually diverging more widely from the parent stock. Buffon argued persuasively from the changes known to be brought about in a series of generations by domestication. Forty years later Erasmus Darwin, grandfather of Charles Darwin, took up Buffon's idea, modified it by his own wide and keen observation, and argued for its probability. In 1809 the great French naturalist, Lamarck, reasoned that the principal cause of the transformation of species was the changes brought about in animals by their strong and repeated efforts to satisfy their desires. In 1844 a Scotchman, Chambers—though he called Lamarck's reasoning foolish—upheld Lamarck's conclusion in an ingenious little book called *Vestiges of Creation.*



HENSHAW WARD

These four imaginative men—no others were important in comparison—kept alive a development theory and had a few followers, but the total effect of their reasoning on scientific thought was almost nil. Huxley has vividly described how disreputable the theory was in the fifties, and Weismann testifies that he could not even learn about it in respectable books during his student days of that period.

Darwin, after five years of zealous observation in a voyage round the world, set himself to study the species question in 1837. For twenty years he amassed evidence, letting only two friends know what he was about, and receiving little encouragement even from them. His *Origin of Species* in 1859 set forth, as Huxley unequivocally states, an idea "that was wholly unknown to scientific thought before 1858."

All previous thought had assumed that environment somehow produces changes in animals. Darwin saw that the truth was the other way round—that *changes originate in the embryo of every plant and animal,* by a process quite unknown to us; that these spontaneous variations can be inherited; that if they are harmful they will not survive in heredity; that if they are advantageous they will be perpetuated, will tend to increase, and will finally cause a race to differ so much from its ancestors that it will be called a new species.

Darwin, by a sort of parable, likened the forces of nature to a breeder, who selects variations. He said that nature acts as if it "selected" unfavorable variations and discarded them, while keeping the favorable ones to form new races.

This idea was a mere hypothesis when Darwin published it. He did not claim that he had proved anything; he simply showed from his wealth of knowledge the strong probability that his idea was true, and he asked what facts could be found that were opposed to it or what other theory could be suggested that would fit the great variety of known facts. Darwin's theory was not accepted because it was clever reasoning about one department of science, but because it neatly fitted all the widely separated departments. It explained the geologic record, the mazes of classification, the life of an embryo, the puzzles of distribution, the marvels of adaptation. It has ever since become increasingly obvious that a theory which accounts for *all* these unrelated fields and bring them into a scientific harmony must be true—unless the universe is a whirlpool of unreason.

Some modern students of heredity minimize Darwin's "natural selection" and feel that they are going to discover a rather different way of explaining evolution. They are so much concerned, in their special work, with the *mode* of evolution that they give the public the impression they are attacking an evolution theory. For one example: Bateson spoke out so radically in

1914 against natural selection that Bryan understood him to be opposing evolution. Yet nothing was further from Bateson's thought. During the rest of his life he declared vehemently that the evolution theory was inescapably true and that he had referred only to a mode of explaining the process. The Batesonians are now a small minority. No rival theory to Darwinism has yet been proposed, much less accepted.

The evolution theory, whatever may be finally approved as the process of it, accounts for all the present forms of plants and animals as developments from earlier forms. It is nowadays as fundamental to all study of organic life as gravitation is to astronomy. A biologist can no more conceive that it will be disproved than an astronomer can imagine that the earth will one day be proved to be flat.

But evolution is a very limited theory. It is purely biological. No astronomer can reason from it to the history of nebulas; no sociologist can argue from it to any law of social development. No philosopher can prove from it anything about metaphysics or theology. The evolution theory is like all advance in knowledge: it shows the operation of invariable natural law, and thus frees us from superstitious fears. To oppose it is to oppose the whole enterprise of liberating the human mind.

John Daniel, 2nd

By ALBERT G. INGALLS

THE Philadelphia Zoo has a new gorilla, a little chap only about a year old. At present, says the *Bulletin of the Zoological Society of Philadelphia,* it is the only living specimen in any American Zoo, the well known youth, John Daniel 2nd, having succumbed to illness despite the remarkably expert and sympathetic care of his owner, Miss Alyse Cunningham.

The writer recalls an interesting and lively hour spent with John Daniel 2nd when he was about three years old. He was every inch a monkey and set out from the start to prove it. Even a "kid" gorilla—80 pounds—is a capable roughhousing partner and John, with 100 pounds disadvantage in weight, was certainly capable enough.

Had I been able to muzzle his teeth, with which he insisted on playfully, but much too enthusiastically, nipping my neck and legs, I felt I might have coped with him, as long as he kept his temper—which he did, though I tried no experiments to find the disposition border line!—for his shoulders, torso and hands were just the size of mine.

John pretty nearly wore me out, and he enjoyed it to just about the same extent that a college boy enjoys roughhousing with his "roomy." Likewise, he acted about the same, continually chuckling as he breathed.

A number of people, accustomed, I suppose, to seeing grind-organ monkeys giving continual attention to parasitic pursuits, have shuddered when told that I scuffled with this "filthy" gorilla. Well—the gorilla was about like a well-washed pet dog, and a darn sight cleaner than some humans. Isn't this belief that all anthropoids are dirty why some people who accept evolution as a principle refuse to accept it as applied to man? Or have I got the cart before the horse?

Predicting by Evolution

By MAYNARD SHIPLEY

ALTHOUGH we still speak of the "theory" of evolution, or the "doctrine" of evolution, the gradual development of higher forms of plants and animals from lowly ancestors is now regarded as an established fact.

Stating the view of the vast majority of living scientists, Professor Henry Fairfield Osborn, President of the American Museum of Natural History, declares that evolution has "long since ceased to be a theory; it is a law of Nature as universal in living things as is the law of gravitation in material things."

It might be objected that by the law of gravitation the astronomer accurately predicts the position of a planet "but who can tell which way a cat will jump?"

No doubt we could predict the direction of a cat's response to internal and external stimuli, if we possessed the necessary data and knew how to interpret the factors involved. The cat jumps under "law"—determinism—as surely as the moon causes a particular kind of eclipse of the sun at a predictable time. Just so, numerous accurate predictions of the existence of then unknown facts or even anatomical structures have been made on the theory of evolution.

For example, it was predicted that more careful study would reveal in the human wrist a central bone. If the theory of evolution, which assumes that the species living at any time are the result of the modification of preexisting species, is valid—that is, if evolution is a fact—at least a vestige of such a bone should be inherited by man from his pre-human ancestors. It was subsequently found to be present in the wrist of the human foetus.

Again, the presence of an extra pair of rudimentary ribs was predicted and later found in the unborn infant—making thirteen pairs, as in the adult gibbon and gorilla. Occasionally a thirteenth pair of ribs appears in the adult neck, just below the thorax, a reversion to a primitive type. In the same way, a fourth molar tooth sometimes appears, the usual number in some of the lower mammals. But while such reversions to ancestral structures might reasonably be expected, they are only occasional, not predictable in a given case.

A notable example of prediction on theory is that made by the German poet-scientist Goethe. In mammals below man there are two little bones in the center of the upper jaw, below the nose. These hold the four upper cutting teeth. In man they had not been known to exist. Goethe, as an evolutionist, insisted that this "mid-jawbone" should be present, a heritage from man's pre-human ancestor. The Fundamentalist anatomists of the period cited their apparent absence as showing that man and the higher apes, gorilla, gibbon, orang, chimpanzee, were not genetically related.

The presence of such bones was emphatically denied by the special-creationist anatomist Peter Camper—at that time the highest authority on comparative anatomy. The great poet-philosopher determined to find the predicated bone. At last he did find it. It is seldom recognizable except in the skulls of youths, since it usually coalesces at an early age with the adjoining upper jawbone; but it is always discernible in the human foetus, as recapitulating in accordance with the biogenetic law, a stage in the earlier evolution of man.

So we may safely say, with Professor Maynard M. Metcalf, that it "can be only the uninformed who fail to accept evolution as a fact established beyond doubt."

Ethics Coming of Age

An Informal Interview with Harry Allen Overstreet, Professor of Philosophy, College of the City of New York

By Barrow Lyons

MEN and women—particularly young men and women—more and more are losing the ancient attitude toward sin. Perhaps it is a good thing. Let's talk about it.

Old ethical systems which attached a great deal of importance to the consequences of sin are today up for appraisal. In a large measure they are the outgrowth of experience under very limited conditions combined with some delightfully naive ideas of what the world is made of.

These rule of thumb ethical systems of the ancient days to some extent met the situations they were intended to meet, but in a great many ways they failed, just as medicine often failed because we did not have science enough to know how to use it.

A significant thing about ethical judgments is that they do not have the immediate testing that judgments in the material world have. One makes a bad tool and soon finds out that it will not work; but it may take several centuries to find out how bad an ethical rule is. In ethical life there is bound to be a hangover from the older generation of ethical rules never fully tested out. This is true in all our ethical relationships—in politics, sex judgments, business judgments and religious attitudes.

Loaded with Emotion

Ethical judgments always are loaded with a certain emotional content. When the tribe believes a certain action is righteous it develops a strong emotional attitude toward that act, and any deviation from the code is regarded with the greatest indignation. Ethical judgments have usually been couched in absolutes. They are not like automobiles—the style of which changes from year to year. In the realm of mechanical things we are quite willing to discard old-fashioned tools. We are not at all willing to discard old-fashioned tools in ethical life—but we should be, when better tools come to hand.

Another difficulty in ethical thinking is that the rules usually are inculcated in childhood. Children are not old enough to make independent judgments, so they are told what to do. They are instructed to eat in certain ways; they are threatened with punishments and warned of sins. Children grow up with ethical assumptions that are supposed to be accepted without question. But it is nothing less than a crime against children to impress them with dogmas at a time when they are helpless to protect their minds.

Ethics a Practical Matter

The question is, how can we modify that attitude? How can we bring a scientific attitude of mind to bear upon morality. Perhaps the first great change in thinking will be in ceasing, as most of our present generation do, to regard ethical judgments as somehow handed down from on high. In this respect, the newer generation, however, is freer than the old. It is progressing beyond the authoritative conception of ethics toward a rational conception. It is taking long strides from the ethics of the immutable Ten Commandments to the ethics of scientific insight.

As a matter of fact, all purely authoritative views today are gradually disappearing, except among superstitious and ignorant people. Just as physical science is teaching us to take care of our stomachs, so ethical science is teaching us to keep our group life healthy.

Just what is good or bad for society, of course, is a matter for interpretation. Perhaps it can be translated into terms of pleasure and pain—happiness and unhappiness—satisfaction and frustration. Or perhaps there are other criteria. But we should see clearly that there is nothing absolute in ethical judgment—that it has evolved as truly as the body has evolved. Hobhouse in his *Morals in Evolution* has made this very plain.

Making the Passage Now

This present generation is actually making the passage beyond the authoritative form to the scientific form of ethics. My own children have been brought up to understand that telling lies is not the sort of thing that makes for the best kind of life in the kind of society in which they wish to live.

That attitude, I think, is the greatest step that has been taken in social evolution. The same attitude is developing in regard to the ethics of sex. Nowadays the lid is off and we are trying to find out what is best. We are trying to find out what sex relationships are fine and what ugly, what make for human happiness and what for misery. Sex today is the great open question. Judge Lindsay's suggestion of companionate marriage illustrates what is happening in the revaluation of sex relationships.

Then there is a whole new system of ethics to be worked out yet, which pertains to the new environment in which we live. When Moses, if he ever lived, led the children of Israel to the Promised Land, there were no labor troubles of our type, no Wall Street, no possibility of organized finance with its great power over the lives of all people, no complex international relationships, no diplomacy, no treaties. Therefore the ethics accepted by those following traditional religion has nothing to say about these relationships.

Question to Fundamentalists

What does stealing mean in business? What should be the ethics of profit-taking, charging interest, making extravagant claims for our goods, deceitful diplomacy for the sake of country? What is the correct ethics for a stronger nation dominating a smaller nation for the sake of carrying on our so-called civilization?

Fundamentalists have nothing at all to offer here; and when they say the Bible is all-sufficient, they simply fail to recognize these great relationships which have come into the world since the Bible was put together.

Women, too, complicate the ethical situation. In the past the world has regarded women as property. Women today are recognized as human beings. Doesn't it seem as though our sex ethics must be rethought in the light of the claims women now make for themselves? What have the Fundamentalists to say about that?

The situation would be ridiculous if it were not, at times, so tragic.

EVOLUTION

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To combat bigotry and superstition and develop the open mind by popularizing natural science

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OUR NAME

EVOLUTION has been selected as the name of this magazine because the evolutionary concept of man's development is the idea upon which fundamentalists have seized to build an issue. It symbolizes the entire conflict between those who see life through the eyes of science and those who look upon it chiefly through the misty superstitions of the past.

The fundamentalists have a strategic advantage in their nearness to the public ear. Men of science are separated from the masses by their vocabulary, dislike of publicity and absorption in work.

This magazine will help bridge that gap by furnishing a forum in which science itself can speak in popular language without fear of the restraints with which fundamentalists are seeking to shackle them.

OUR POLICY

THE preliminary announcement of EVOLUTION stated that:

"EVOLUTION will be non-political, so that all upholders of academic freedom can support and use it no matter how they differ on other issues. It will be non-religious, never making any effort to reconcile science with religion. Nor will it make atheism its mission. It will carry the positive message of facts from every field of natural science and leave it to the reader to make his own mental readjustment."

The favorable reception accorded to this announcement convinces us that this policy will develop a large field of usefulness for EVOLUTION. With full realization of the difficulties involved, EVOLUTION will endeavor to hew to this line.

FROM MULES?

IT is pretty certain that two people, evolutionist and anti-evolutionist, will outrageously misrepresent themselves when they get into an argument about evolution. Each moves to the extreme opposite position and sticks there like a bull dog to a root. Not a jot of impression, for all the arguments leveled at him, will either reveal. Yet, when the tumult and the shouting have died away each has picked up something to think about, though admit it to the other he certainly never will.

That's the only good of the superheated argument. The surprising thing is the hope that springs eternal that the one disputant will get the other overtly to give in. That should not be expected—it isn't human nature.

Man must be descended from mules, not monkeys. A. G. I.

THOSE IGNORANT AMERICANS

ENGLAND has made a discovery. She harbors, right in her midst, a number of souls who do not believe in evolution! We had supposed, after reading innumerable rather smug, self-satisfied criticisms of America's ignorant backward population, that every Englishman from William the Conqueror to George the Fifth, and from Land's End to John O' Groats was an authority on organic evolution.

The day after Sir Arthur Keith, famous anatomist-evolutionist, presented his presidential address on Darwin's theory of evolution before the British Association for the Advancement of Science, the British backfires began. The address got into the papers where the plain people—not, of course, ignorant and backward like ours—got hold of it. The old controversy, supposed to be dead in England since the eighties, awoke to life again.

Said Sir Arthur Keith with surprise: "It is clear that Daytonism is alive and vigorous in England. There are still, I am surprised to learn, many men and women who are convinced there is only one reliable account of man's origin—that given in the Book of Genesis."

The trouble has been, all along, that the educated Englishman, accustomed more or less to ignoring the opinions of the common people of his country, has insisted on comparing the beliefs of England's intelligentsia with those of America's masses. A. G. I.

FUNDAMENTALISTS ANNOUNCE NEW CAMPAIGN

THE Associated Press reports that Dr. W. H. Riley, President of the World's Christian Fundamentals Association has just announced in Oklahoma City the launching of a new attack against teaching evolution in Kansas, Oklahoma and Arkansas. In Kansas and Oklahoma the fight will be in the legislatures, while in Arkansas they will appeal direct to the voters through referendum.

Dr. Riley has promised to write an article for EVOLUTION stating the fundamentalist plans. We hope to receive it in time for our next issue.

CONTRIBUTORS TO THIS ISSUE

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WILLIAM K. GREGORY: noted authority on comparative anatomy and vertibrate paleontology; Fellow and Vice President of the New York Academy of Sciences.

ALBERT G. INGALLS: associate editor of *The Scientific American.*

DAVID STARR JORDAN: President Emeritus of Stanford University; noted naturalist exponent of Darwin's theory of evolution; author of many books on science.

HARRY ALLEN OVERSTREET: head of the department of philosophy at the College of the City of New York and a leader in modern thinking upon ethical problems.

MAYNARD SHIPLEY: President of the Science League of America and author of *The War on Modern Science.*

HENSHAW WARD: author of *Evolution for John Doe, The Circus of the Intellect* and *Exploring the Universe.*

SCIENCE WILL BE FREE

By Horace J. Bridges

"INFIDELITY," said Thomas Paine, "does not consist in believing, or in disbelieving; it consists in professing to believe what one does not believe."

This real sort of infidelity is instantly betrayed by those who seek to suppress, by legal prohibitions and penalties, the doctrines to which they are opposed. Professing their own faith, they betray their unfaith—their secret lack of real confidence in their doctrines—by the very means they adopt to safeguard them. For when a man is really sure, he is serene; he knows that truth, as Milton said, can never be put to the worse in a fair encounter; he is eager for the justification that must come to a true belief after the utmost skill and energy of its opponents have been exerted to demolish it.

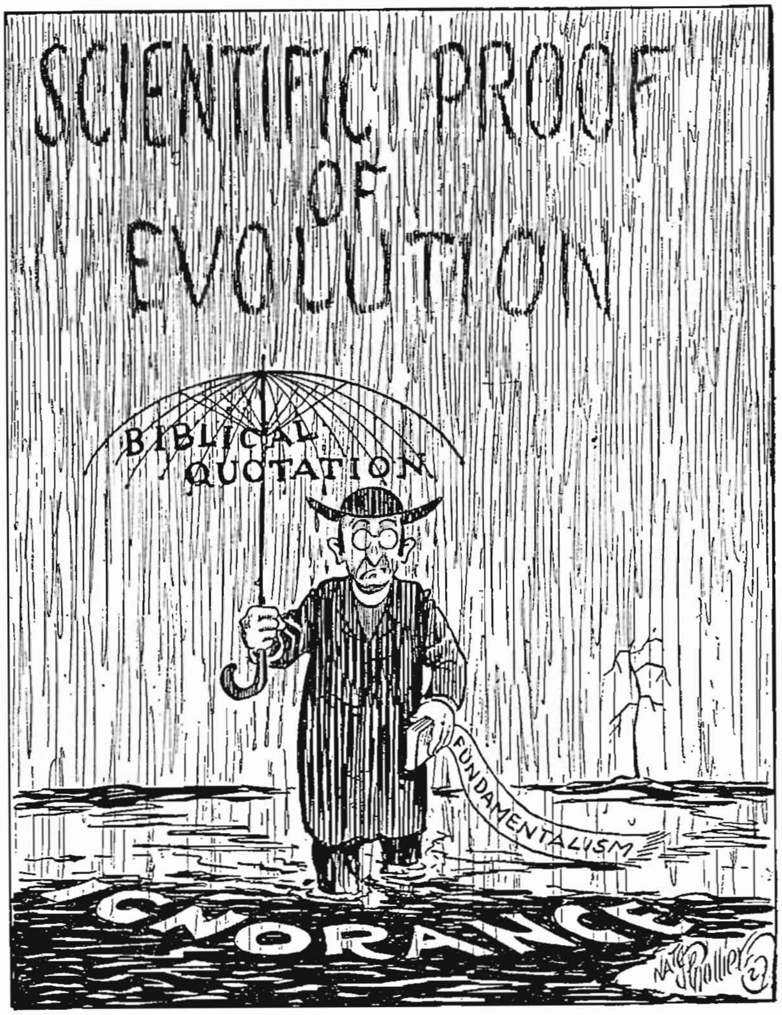
The campaign against evolution offers an immense premium to hypocrisy and insincerity. If a teacher believes in evolution, but is willing to enact the lie of silence, and pretend that he does not, and to teach what he does not believe, then, in States that pass anti-evolution laws, his job and his pay are safe, and promotion awaits him. But if he is determined to be honest and truthful, he is penalized and cast out.

Can anybody believe that the Fundamentalists would have resorted to this policy of the Inquisition, this revival of Dominican methods, if they had seen the slightest chance of the masters of science ever abandoning evolution? Can anybody believe they would have sought to buttress their dogmas by penal laws if they were really convinced that those dogmas could be effectively defended by appeal to facts and reasoned arguments? Who ever heard of laws being invoked in the interest of mathematics, or physical science, or philosophy?

Let the issue be joined then. "We are in earnest—we will not equivocate—we will not excuse—we will not retreat a single inch—and we will be heard."

Whatsoever science discovers, the schools shall be free to teach. Theories shall be called theories, and hypotheses hypotheses. The facts that suggest them shall be exactly set forth, and our young men and women invited to let their minds play freely upon them. And established laws—that is, theories found to accord with all the known facts, and accepted by the consensus of the competent—shall be taught as laws, no matter what traditional doctrines they traverse or displace.

Evolution is one of these laws; and we stand for it, and shall fight for it, because loyalty to truth demands this, and no other loyalty can be permitted to come into conflict with that supreme one.



New Umbrella, Mister?

ENVIRONMENT'S THE THING

FOSSILS many millions of years more ancient than the oldest fossils previously known have recently been found in eastern Finland and sent to the British Museum. They are fossil algae, a primitive form of life which may still be found in one form or another all over the world.

This calls to mind the question often sprung by the anti-evolutionist, "If all the animals are supposed to have evolved from primitive forms like this, how does it happen that there are any of these primitive forms left?"—a perfectly logical question. Logic often leads astray, however. All the higher organisms did evolve from such ancestors, but not all the ancestors evolved into higher organisms. Some of the forms were thrust into environments that put them to it for a living. Under adversity—not too great—they evolved. Others met litle adversity and stayed "as was" all down through the geologic eras.

The same "logic" is often applied by the antis to monkeys: "How is it all these ancestral monkeys of the early Tertiary Period didn't become human beings, so that there would be no monkeys left today?" A little homily will illustrate: If you take a monkey, surround him with conditions under which he has to scratch pretty hard for a living, you make a man of him. Take a man, give him everything he wants, deprive him of the incentive to work, and you make a monkey of him. A. G. I.

A Battle Cry to True Fundamentalists

By the REV. PORPHYRY LUMMOX

Brother Fundamentalists:

It is with deep regret that it becomes my duty to review a year of effort marked by sad reverses and but few advances for the Fundamentalist cause. We might as well be honest with ourselves and face the facts. Though science deny him, Satan still is gaining ground and unless those who feel deeply the danger for those who are dear to them mobilize, a condition eventually will come about in which a Fundamentalist will be as out of place in this world as an Angel of the Lord would be in Hell.

Bills which our supporters have introduced in the Legislatures of West Virginia, Missouri, Connecticut, Arkansas and Oklahoma all have been voted down, some of them by a very slight margin, it is true, but nevertheless a sufficient margin to permit the continuation of the teaching of subversive evolutionary propaganda designed to pervert the youth of America for the Devil's own purposes. When one views the defeat of one measure after another prepared to protect our youth from blasphemy, who can doubt the existence of a Spirit of Evil—a real Satan—as real as he who once pointed out the pleasures of the world from the mountain.

Florida a Bright Spot

There was just one State in which right triumphed in the Legislature. In Florida the House passed a bill by a majority of 67 to 24 making it unlawful to teach in the public schools of the State "any theory that denies the existence of God or divine creation of man." Here is clearly the hand of God working through his chosen agents, the legislators. It is pitiful they do not also appropriate more money for the improvement of the schools, but perhaps we should not expect improvement in too many ways at once. It is a crying shame, too, that more is not done to protect the health of people within the State. Where there are so many ardent Fundamentalists we cannot afford to have their ranks thinned by disease which might be prevented.

The tocsin was again sounded by our great Dr. W. B. Riley, President of the World Christian Fundamentals Association, when that most important of our American institutions met last May at Atlanta.

Asleep too Long

"It is time for Fundamentalists to act. We have been asleep too long," Dr. Riley declared. I regret only his phraseology, for being asleep too long is just what our opponents, the Modernists, charge us with. Lack of success in our efforts, Dr. Riley pointed out, has resulted chiefly through lack of preparation. Sufficient of the customary pressure was not brought to bear upon the legislators by our associates in practical affairs.

As Dr. Riley pointed out, it is the idea of trying to civilize the world rather than to evangelize it which has cost us so dear. It is this false idea of the real objective of religion, this modernizing idea, which caused the fall of the interchurch movement and which brought into disrepute the Federal Council of Churches.

Nefarious Professors

I regret exceedingly to say that our foes are beginning to organize. It was at the American Association of University Professors' meeting last winter in Philadelphia that steps were taken by that society to bring our opponents together. This organization is composed almost entirely of rabid evolutionists—men who are virtually sworn to uphold the nefarious Darwinian doctrines. They are, perhaps, the most serious menace the nation now faces.

The avowed purpose of this group is to take the initiative in organizing all groups interested in defeating the bills which we propose in the various State Legislatures. These professors undoubtedly are subsidized by the liquor interests.

One Scoundrel Less

There are a few encouraging signs, however, which point to opportunities for Fundamentalists. With Governor Richards of South Carolina on the board of trustees, Winthrop College has removed from its faculty a snake in the grass—Professor William Garner Burgin, who insisted upon teaching evolution to his classes. What diabolical influence men like this are able to exercise was clearly shown when more than eighty students repudiated charges of improper conduct against Dr. Burgin and virtually flouted the college authorities. There could be no more striking example of the manner in which the evolutionary doctrine is undermining the morals of our boys and girls.

There is also hope in the establishment of a Fundamentalist college in Des Moines. With ringing words Dr. E. O. Kaserman, head of the biology department, denounced modernist science as narrow and intolerant at the ceremonies attending the taking over of the school by the Baptist Bible Union. It is encouraging to note that over twenty members of last year's faculty have resigned since the Union has assumed control of the college. It seems that these so-called teachers remarked in an attempt at humor that they couldn't swallow the story of the whale swallowing Jonah.

You must realize, however, that to carry on our effort requires money. I hate to mention the subject, but it is one of the hard facts of life, just like the existence of Satan, that we must face. Nevertheless, it is comforting to realize that while the evolutionists may be rich in ideas, they are far poorer than we in the necessary dollars, which are still powerful weapons in the cause of richeousness.

THE ENGLISH ROW

QUOTH the Rev. Dr. E. W. Barnes, Bishop of Birmingham, before the youth of Westminster School:

"Darwin's triumph has destroyed the whole theological scheme. Man is not a being who has fallen from an ideal state of perfect innocence; he is an animal slowly gaining spiritual understanding. It is quite impossible to harmonize this conclusion of scientific inquiry with the traditional theology of any branch of the Christian Church. If, then, opinions widely and even universally held turn out to be wrong let us declare the fact, and we need not blush as we make our confession."

That started the row. The Church of England awoke to find itself split into two camps. Said Dean Inge of St. Paul's Cathedral:

"The doctrine of evolution has long been accepted in the broad outlines by all educated people, the clergy included. The tendency of religious persecution has clung to Christianity like a shadow ever since the two apostles incurred the rebuke of their Master by wishing Him to call down fire from Heaven upon a village which would not receive them."

Wrote Bishop Barnes to the Most Rev. Randall T. Davidson, Archbishop of Canterbury and Primate of All England:

"No man shall drive me to Tennessee or to Rome."

Whereat the Primate of All England replied:

"You may dismiss the fear that any one in England will drive you either to Rome or to Tennessee. I believe you overrate the adherence of thoughtful people to creation theories of fifty to 100 years ago."

But the fight is not over. There are those who still cling to the idea of creation in a week, Adam and Eve in the Garden of Eden and all of the ancient oriental mythology. They are very serious, earnest and sometimes forceful people.

FUNNYMENTALS

"NO INFIDEL, Atheist or Agnostic shall be employed in any capacity in the University of Texas. . . . No person who does not believe in God as the Supreme Being and the Ruler of the Universe shall hereafter be employed."

—*Rule adopted by the Regents of the University of Texas.*

"Any thoughtful man should be against this awful theory of evolution. It should be legislated, routed, run and kicked out of existence back to its place of origin which is in hell, because its teachings are against the word of God."

—*From a letter written to "The Knoxville News."*

"I accept and believe the Bible account of Creation as the direct act of God; the Bible record of miracles; the immediate and infallible inspiration of the Holy Scriptures as the very word of God. . . . As a teacher I will, without compromise, steadfastly stand for these fundamental things, and actively resist every encroachment upon them within my sphere of service."

—*From the Bethel College Credal Statement, quoted from The Cumberland Presbyterian Bulletin, McKenzie, Tenn.*

"If a minister believes and teaches evolution, he is a stinking skunk and a liar."

—*Billy Sunday.*

"We are not going to stop until we have driven every Modernist out of our pulpits and seminaries and editorial chairs. We are going to put them out *if it takes our lives to do it.*"

—*The Rev. Charles Hillman Fountain, Plainfield, N. J.*

"If the evolutionists are getting ready to produce proof that our forefathers—way, way back—really were monkeys—let's get together and Ku Klux them before their proof gets before the public—let's quit chattering about it and act—let's stop them from monkeying with such subjects."

—*Editorial from "The New Menace."*

"So far as I am concerned, so help me God, I will not be a party to wink at, support, or even remain silent when any group, clique, crowd or machine undertakes to ram down the throats of Southern Baptists that hell-born, Bible-destroying, deity-of-Christ denying, German rationalism known as evolution."

—*The Rev. J. Frank Norris in the San Antonio "News."*

JUST TWO WEEKS OLD. ASK YOUR FUNDAMENTALIST FRIEND HOW HE EXPLAINS THIS

ON ENEMY TERRITORY

WARFARE will be carried into the enemy territory when the subject of evolution is discussed at the next annual meeting of the American Association for the Advancement of Science assembling in fundamentalist Tennessee. At the Nashville convention, which will be held during Christmas week, a number of noted scientists are expected to discuss the subject.

The association is particularly well adapted to bring the problems raised by anti-evolutionary propaganda before the attention of the public because of its large membership, amounting to approximately 17,000 people in all parts of the United States and abroad. Through its meetings and publications, it keeps this group in touch with current happenings in the world of science and promotes cooperation and good fellowship among scientists. Through its meetings large numbers of scientists are brought into friendly contact and given an opportunity to understand one another's points of view.

The weekly journal, *Science*, which is the official organ of the association, furnishes an open forum for the discussion of questions relating to science and education. It is sent free to all members in good standing. Members also receive reports of meetings.

Expenses of the organization are met by the $5 entrance fee and the yearly dues of annual members at $5 each. All who are interested in the work and aims may obtain further information by addressing Dr. Burton E. Livingston, Permanent Secretary, Smithsonian Institution Building, Washington, D. C.

CO-OPERATE BY CLIPPING

Readers are invited to send clippings of news and articles that they consider interesting, being sure to give date and name of publication from which taken.

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Additional capital furnished now will help make the circulation campaign for EVOLUTION magazine a success. Checks should be made payable to EVOLUTION PUBLISHING CORPORATION. In remitting kindly state whether payment is made in full, or whether it should be applied on a larger block of stock to be held until the balance is paid.

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Of course you'll show this issue of EVOLUTION to your friends and ask them to subscribe. But you probably know some who would be interested, whom you can not visit yourself. Send us their names and addresses and we'll mail them sample copies.

It will cost us about five cents a copy to send out these samples, so if you can send along a check to help pay for them we'll not object. However, if your bank account is minus don't let that stop you. Send us the names anyway and we'll raise the cash otherwise.

WHAT'S A HUNTER WITHOUT AMMUNITION?

A hunter without ammunition is in the same fix as an evolutionist without copies of EVOLUTION. Surely YOU don't want to remain in such a pickle. The best way out is for you to fill in appropriate characters on the following blank in a hurry.

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Science Notes

A CYCLOPIAN HUMAN RACE?

SOME of our remote ancestors, the paleozoic lizards, living probably under water, had a third eye on top of the head. When this third eye lost its biological usefulness, it gradually degenerated and finally disappeared. The pineal gland, deeply embedded in the human brain, is thought to be a vestige.

"Will evolution stop with the present two-eyed scheme, or will human beings develop into a one-eyed, cyclopean race?" we now are asked by Dr. Thomas Hall Shastid, opthalmologist of St. Luke's Hospital, Duluth, Minn. He reports that from 95 to 100 per cent. of the detail of any object comes to the brain through the right eye, if the person is right-handed; while if he is left-handed the left eye as a rule takes up the major portion of the detail. This means that the human brain does most of the seeing through one eye, even when both eyes are open.

In an article in the November *Scientific American*, Dr. Shastid deduces from this that man's right eye eventually will become his only eye, and that even now his stereoscopic vision is being destroyed.

"The great cyclopean eye, however, will regain stereoscopic vision by developing two *maculae*—the most sensitive spots—in the one eye, just in the fashion in which many birds have stereoscopic vision in each eye now," says Dr. Shastid. It will probably be able to perceive as light many forms of energy which now produce in human eyes no sort or kind of perception."

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A SPIRAL NEBULA; THE QUESTION MARK IN THE SKY

OURS NOT THE ONLY UNIVERSE

DR. ALLAN DOUGLAS MAXWELL and associate astronomers of the Lick Observatory on Mount Hamilton, California, have taken new measurements of the Milky Way. Using a new type of spectroscope, fitted on the Crossley reflector of the observatory, they measured about 2,000 of the faintest stars, sixteen thousand times too faint to be seen by the naked eye.

According to their calculations the diameter of our universe is about 350 quadrillion miles, or about 60,000 light years. A light year is the distance traveled by light in one year's time going at a speed of 186,000 miles a second.

The farthest stars that they measured are about 100 quadrillion miles from our earth. This means that the light entering the telescope left the star about 15,000 years ago.

It is now supposed that the nebulae, once believed to be incandescent gases lying far beyond our universe, may be other universes, in reality clouds of suns so far away that the separate stars cannot be distinguished. In recent years many thousands of these have been photographed and catalogued. It is estimated that a very powerful reflector, like that at Mount Wilson, is capable of photographing several million of them.

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I'll stake you to a dollar's worth of EVOLUTION, twenty copies, if you'll write me right away for I know they'll sell like hot cakes at your first meeting Address: Katterfeld, c|o EVOLUTION.

WHAT IS THE SCIENCE LEAGUE OF AMERICA?

THE Science League of America was formed in 1924 to combat the efforts of Fundamentalists to abolish the teaching of modern evolutionary science in tax-supported schools and colleges of this country. It was incorporated in 1925, and maintains national offices in San Francisco. It has branches in several cities, and members in 47 states and the District of Columbia, Canada, Mexico, Hawaii, Alaska, the Philippines, Cuba, Porto Rico, Brazil, England and France; and in the faculties of practically all important colleges and universities in the United States. Membership is not, however, confined to scientists, but is open to any man or woman who believes in protection of freedom in science teaching and in complete separation of church and state. The League is non-sectarian and non-political, including both Modernists and Rationalists, and approaching the question at issue from a scientific point of view.

In every state threatened with an anti-evolution law the Science League furnishes the committee of the legislature with a protest brief in the name of its members in that state, and arranges for a representative to speak in its behalf against the bill. The state newspapers are also supplied with information and arguments for use in opposing the proposed action. Besides this, over a thousand newspapers and magazines are kept regularly in touch with news of the war against evolution, and from time to time magazine articles are written by the president giving the history and present status of the anti-evolution agitation.

Protest also is made wherever possible against anti-evolution action on the part of boards of education and similar bodies; publicity is given to cases of dismissal for the teaching of evolution; and occasional educational lectures on evolution and public meetings are held. The League's funds are derived from membership dues—$3 a year, life membership $25. Plans include an extension of the work outlined above, establishment of more branches in state capitals for local autonomous action, and possible test cases in states where the fundamentalist drive has been successful.

A leaflet more fully descriptive of the work and aims of the Science League will be sent on application to 509 Gillette Building, San Francisco, California. All readers of EVOLUTION who are in sympathy with the purposes of the League are cordially invited to co-operate with it as active members.

THE WAR ON MODERN SCIENCE. By *Maynard Shipley*. Published by Alfred Knopf: $3.00.

ONLY an ostrich with his head in the sand could deny, after reading Maynard Shipley's "Short History of Fundamentalist Attacks on Evolution and Modernism" that these constitute a veritable WAR ON MODERN SCIENCE. The evidence compiled in this volume of over 400 pages is overwhelming.

By way of introduction Mr. Shipley gives an adequate analysis of the philosophy upon which the conflict is based and explains the aims and purposes of the fundamentalists as opposed to the methods of science. He then traces the far-flung battle line between the army of reaction and modern science State by State.

In his final chapter on What Is To Be Done he disposes of the pacifist who believes he solves the problem by just letting fundamentalism "go to seed" and sends out a clarion call to action. "Meet organization with organization" is his program, "Build the Science League of America."

Every statement made by the author in this book is buttressed by citations from authorities. In fact it is a veritable arsenal of ammunition for the Evolutionist in the front trenches of the battle line.

L. E. K.

EVOLUTION FOR JOHN DOE. By *Henshaw Ward. Bobbs-Merrill Co.*, $3.50.

LIKE the rest of us amateurs at science, Henshaw Ward has sought the "plain account of evolution—not something written down to the level of a moron, not a nature-loving rhapsody, but an actual description for intelligent people." He did not find it. So he kept on asking, among others, his professor friends at nearby Yale University. Perhaps he pestered them too long, or they recognized his native capacities. At any rate a professor of anthropology one day exploded with the suggestion: "You write it. You have some knowledge of the sciences involved; you have imagination; you have long experience in writing of varied sorts; you are excited about the wonders of modern biology. Why don't you tackle this evolution job? It will keep you busy for a while."

Mr. Ward was amused, then interested. It had possibilities. He asked a biologist friend. "Don't try," was the answer. "It can't be done." That settled it. He made up his mind to do it.

After two years he had a manuscript ready. He asked the professors for criticisms. They corrected some things, challenged others. They cleared it of technical errors. The result was *Evolution for John Doe.*

So now it has been told, this full and magic life-story of the world. Endorsed by scientists, prepared by years of study and research, Mr. Ward has written a volume of immeasurable value and interest and importance to Mr. John Doe.—*A. S. B.*

MY HERESY: *The Autobiography of An Idea.* By *William Montgomery Brown.* The John Day Company: $2.00.

INSTEAD of giving you a conventional review of this remarkable book by Bishop William Montgomery Brown, I'll merely say that it is the most sincere and human document that I have ever read, and quote a few sentences from one chapter headed "My Universe Disappears":

> "I began to read *Origin of Species.*" . . . It was a completely new kind of reading matter to me. It seemed to take nothing for granted. It did not lay down a principle to be proved. There was no apologetics here, no attempt to "justify the ways of God to man." Also there was no "inner light," and no profound conviction upon the part of the author that he had been ordained to extinguish other people's lights so that the whole world should thereafter use nothing but his.
>
> "This Darwin was not seemingly concerned with making converts. He was just noticing things—living things—and watching how they acted. . . . If some one had noticed something that he had missed, or if his own notes were incorrect in any way, he would be awfully obliged if corrections were made.
>
> "To me, who had been used to controversial literature, this was extraordinary reading, for something very strange had happened to me. I had become curious about life. . . .
>
> "To learn about life by noting how it behaves, instead of laying down a law of behavior, surely had its fascinations. This was my first experience, and it filled me with terror, but I soon found that I could not stop. I finished *Origin of Species* more eager for knowledge than when I picked it up."

What happened to this orthodox Episcopalian Bishop who had become "curious about life" and "eager for knowledge" makes a tale more interesting than any novel. It is the kind of story that you will not only enjoy reading yourself, but you'll ask your friends to read it just as I am asking you to read it now. And the reading of it will mark the turning point in many a life.

L. E. K.

AN OUTLINE OF MAN'S KNOWLEDGE.

By Clement Wood. Published by Lewis Copeland Company, Inc. $5.00 Just received. Will be reviewed in our next.

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How many will follow this month the trail that they have blazed? All that send in four or more subscriptions will be acknowledged in this column. We'll measure our success not so much by the number of copies of EVOLUTION that we sell as by the number of readers who think well enough of this little journal to ask their friends to subscribe for it.

They are the greatest encouragement that any magazine could have.

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HAVE A LOT OF FUN

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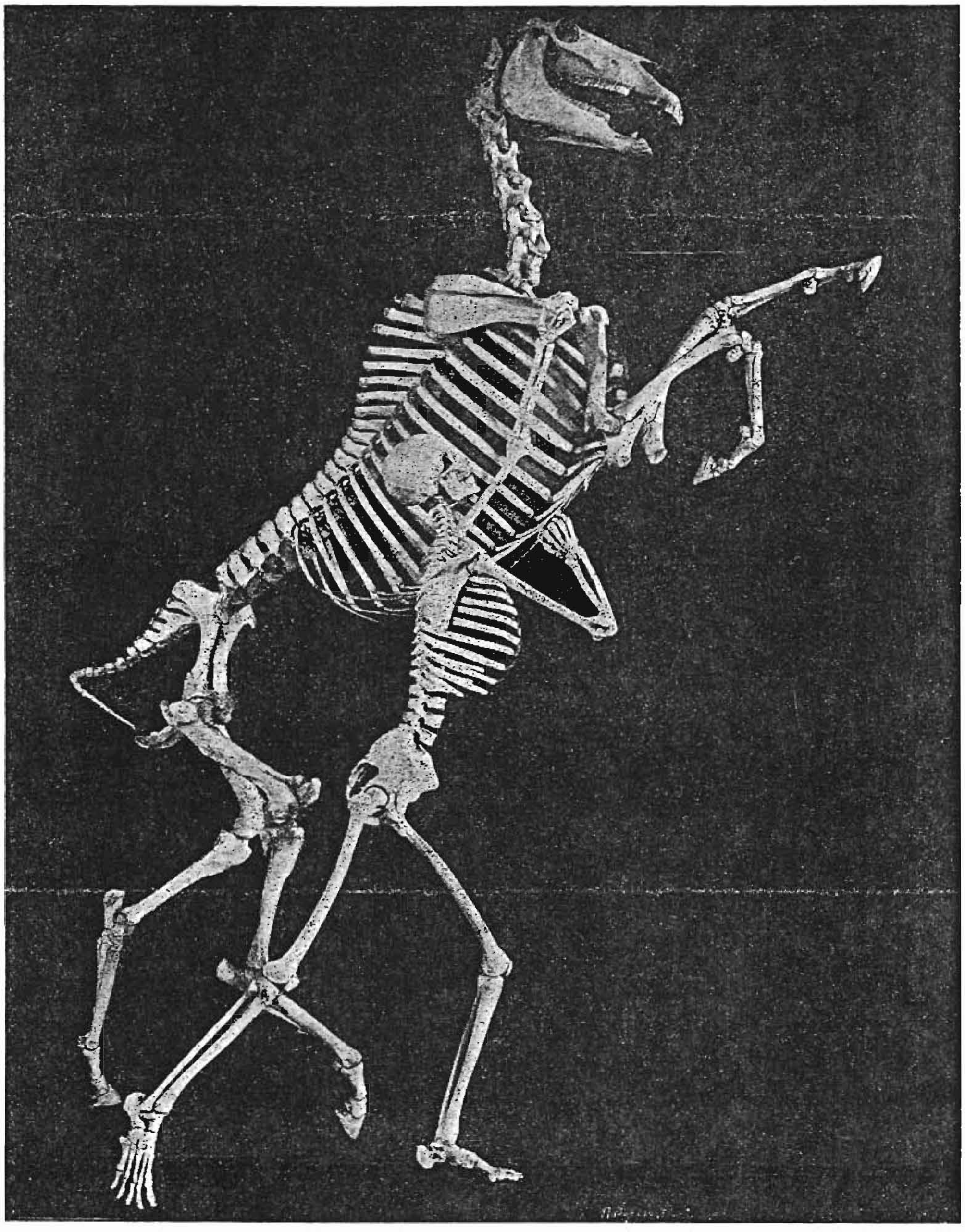


HORSE
AND
MAN

Courtesy of American Museum of Natural History

WHAT DO YOU KNOW ABOUT YOURSELF?

Man's Complete History

By GEORGE A. DORSEY

THE exact spot where Man was born is not known. There are two versions as to the date of his birth. One—the Mosaic, as interpreted in 1654 by Bishop John Lightfoot—says that "Man was created by the Trinity on October 23, 4004 B. C., at nine o'clock in the morning." The other—the Book of Nature — estimates Man's birth at 80,000,000 B. C.

GEORGE A. DORSEY

Moses wrote the Book of Genesis about 1500 B. C. God began the Book of Nature at the Beginning of Eternity; it will be finished at the End.

Man at first was so small he could play hide-and-seek in a needle's eye. His name was Bacterium. He was the only living thing. Land and sea were not yet fit for other life—there was no food to live on. It was Bacterium's job to make the world fit. For eons he plugged away, turning rock into soil.

The little Algae, half-brothers to Bacterium, helped mightily, turning sunshine into food.

The pyramid of life had begun.

Other chemical elements were taken up into the little bodies. More millions of years and inconceivable labor. Real protoplasm came to be.

Meanwhile the earth had doubled in size and was now fit to live on. Man was now a real cell. He could move about, could multiply. He could make more protoplasm—living matter, food.

We think we work. In five years one pair of one-celled organisms could produce 10,000 food-balls, each the size of this earth.

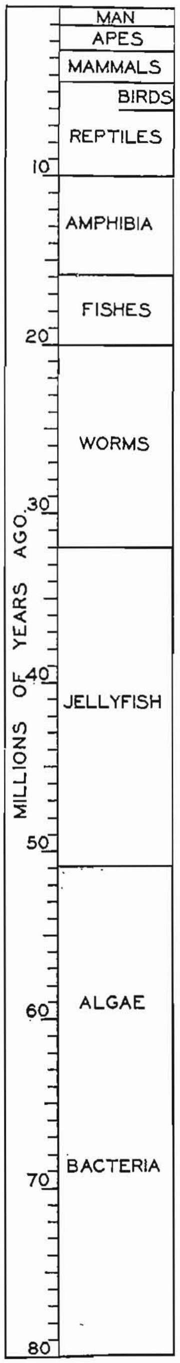
Even then Man was a better engine than he has ever made; he could stoke, repair, adjust, increase and preserve himself. He was more wonderful than the sun—the sun cannot reproduce itself. Man could, even when he was only one-cell big—and at that so small that billions of him could hide in a thimble.

Many cells organized to make a body. This could distribute its work, save up for a rainy day; part could rest while other parts worked. An epoch-making step.

Marvelous progress from now on. Tryings on of many bodies. Tryings out of new foods, new ways to get food, new safety devices, new ways to avoid death. Innumerable failures. But, in general, progress.

From round—like a Jellyfish—Man became long—like a Worm. He could tell right from left now, and his head from his tail. A big step—especially when he sprouted legs. He could go on journeys. He had blood cells to get oxygen. Muscles. Alimentary canal. Eyes to see with.

OUR PEDIGREE



Another epoch—about twenty million years ago: Man became a Fish. Jaws, gills, fins, scales. He began to grow a skeleton—at first a mere gristle shell to protect his tiny brain. His skull today has not forgotten its origin.

Then Man started for dry land. Developed lungs. Changed fins into fingers and toes. A great step forward. His name was Amphibian. He liked himself so well he sang a song, the first vocal music this earth ever heard. Even today Mrs. Frog cannot find her mate unless he croaks.

Man learned to love the sun: he became a Reptile. Ten million years ago. He had a big brain, a four-chambered heart, warm blood. He could breathe through his shell.

Man lost part of his family here, certain Reptiles took to the air and became Birds. Not Man himself. He stayed on the ground and perfected an incubator for his eggs and built it inside his body so he could carry it with him. He developed milk and called himself Mammal. He tried out several types of bodies, kinds of teeth, and methods of locomotion.

But the Eagle had a more perfect body, keener vision, and better circulation; it could travel faster and instead of coarse hair had fine feathers. Man decided he would fly. His body was too heavy; he could only carry it to the tree-tops. He decided to stay there and be a Primate.

Man now had the time of his life. But he was top-heavy; he had more brains than he could use in a tree. So he climbed down, left off his tail, began to straighten up, and change his name to ape. That was two or three million years ago.

He shortened his arms, lengthened his legs, straightened up, balanced his head; became Man. That was probably one million years ago.

(Another article by Dr. Dorsey in next issue of EVOLUTION*)*

Man and Nature

By ALEXANDER GOLDENWEISER

SOME two generations ago Huxley startled the world by his little masterpiece, "Man's Place in Nature." What was heresy then, has since become a commonplace, except, perhaps, in Tennessee.

ALEXANDER GOLDENWEISER

Now, Huxley as a biologist was primarily interested in the relation between man physical and the higher animals, especially the anthropoid apes. We need not accept this limitation. Our topic then will be man's place in nature viewed from the standpoints of physics, chemistry, biology and psychology.

Man, first of all, is a thing, a physical object subject to physical world and laws that control it. Man has weight, volume, size. His body has a certain temperature. It expands in heat, contracts from cold. The muscles of the body exert certain pulls on the bones, the bones themselves articulate with each other like the parts of a machine. When a man falls from a rock into a precipice, he falls like a stone falls in strict conformity to the law of falling bodies. Whatever else man may be, then, he is first a physical object.

But beyond this man is also a chemical composite, a highly complex one. Not only are the different components of the body—the blood, bones, glands, bile, urine—expressible in chemical forms, but the functioning of the organism consists largely of chemical processes, such as breathing, digestion, vision, cell metabolism. The body of man is like a huge laboratory in which chemical substances are constantly being formed and destroyed. So, man is a chemical composite.

But man is more than this: he is a living organism. Like plants and animals, he has life. In common with plants, he is composed of living cells, he originates from a cell, he grows transforming organic and inorganic substances into constituent parts of his own body, he ages and he dies. In many ways, man is like a plant.

Beyond this, he is even more like an animal. He is born from the parent organism after a protracted embryonic period spent inside the maternal body, as is the case with many animals. Like all animals, he has the power of spontaneous motion. Like all animals, he has certain instincts—more complicated native dispositions than are the reflexes or tropisms of plants—which guide him in the quest fur food or sex and in avoiding dangers. Like all higher animals, man has sense organs which facilitate his orientation in the world about him. Like all vertebrates he has a spinal column around which his skeleton is built. And, like all higher animals, he has a nervous system and brain which make his reactions to external and internal stimuli much more accurate and effective and versatile than they could otherwise be. Man, moreover, is a mammal; he brings live offspring into the world, as do tigers, lions, elephants, whales, horses, dogs and pigs. The young are fed at the mother's breasts as among all the mammals.

Man, finally, is like a monkey and especially like an anthropoid ape. His skeleton, the formation of his skull and of the external sense organs on the head, are more like those of monkeys and apes than they are like those of other animals. The monkeys and apes, moreover, approximate man in their psychological faculties; they have hands with which they can manipulate things with great agility. The anthropoid apes, moreover—the gorilla, orang-utang, chimpanzee, gibbon—have a relatively large brain; not as large or heavy as that of man; either absolutely or relatively to the size and weight of the body, but larger and heavier than the brain of most other animals with some exceptions which we need not here consider.

Man, then, is like a physical object, like a chemical composite, like a plant, like an animal, like a vertebrate, a mammal, a monkey, an anthropoid. Anyone who would examine nature with an open mind and discover man in nature so like many other things and creatures, would conclude that man belongs to nature, that he is part of nature, made of the same stuff and possessing the same properties. This man would be right. He would, moreover, express *not a theory but a fact,* the fact that Man and Nature are basically one.

But there may be other facts which this man, observing and judging as he did, may have overlooked. In the succeeding articles of this series—"Episodes from the History of Evolution":—

I. How Darwin and Wallace discovered Evolution
II. The Spencer-Weissmann Controversy
III. Huxley and the English Bishops
IV. Ernst Haeckel reconstructs the History of Man
V. Haeckel gets into Difficulties
VI. Osborn traces the Ancestry of the Horse
VII. De Vries supplements Darwin
VIII. Morgan brings Evolution Up-To-Date
IX. Are Acquired Characters Inherited
X. Were Our Ancestors Pygmies
XI. Evolution and Race
XII. The Facts of Evolution

I shall consider in greater detail on what facts is based the scientific conviction that man is part of nature as well as on what facts is based the equally scientific conviction that man stands unique in nature.

(Dr. Goldenweiser's second article will appear in next issue)

Is Evolution A Guess?

By HARRY HIBSCHMAN

ANTI-EVOLUTIONISTS and Fundamentalists are so persistent in contending that evolution is not a fact but a mere hypothesis, theory, or guess, that it seems worth the time and effort to point out the fallacies in their arguments and to note the conclusions of eminent scientists themselves regarding this subject.

The foes of evolution err wilfully or ignorantly in three respects:

First, they fail to distinguish between the fact of evolution and the explanation of evolution. The scientist accepts as scientifically established the conclusion that present existing forms of life, including man, have been derived by a natural process from earlier, simpler and lower forms that themselves came from distant inorganic aggregates. As to how this happened, there are various views of theories. Regarding them there is great difference of opinion. But a rejection of a given theory of evolution, or of all present theories, is not a denial of evolution itself. Evolution as a fact has been proven. The theory of how it operates is something quite different.

CONFUSE DARWINISM AND EVOLUTION

Second, they confuse Darwinism and evolution and speak as if the two meant the same thing. Darwin brought together in logical and decisive form the evidence of the fact of evolution, and his conclusions on that point have been accepted as sound. At the same time he undertook to explain the process of evolution, suggesting that it took place through natural selection and the survival of the fittest. This is Darwinism—Darwin's theory regarding the way of evolution. It may be totally wrong. Many who accept the conclusions of Lamarck or De Vries think it is at least inadequate. But it does not follow that if Darwin's particular theory as to the manner of evolution is rejected, the conception of evolution itself is rejected or even attacked.

A simple illustration will serve to clarify the distinction. Suppose that John Doe and Richard Roe are walking down the street one morning and come to the still smoking debris of a school building that burned down during the night. They examine the ruins and try to determine how the fire originated. John Doe, finding some rags soaked with kerosene, says it was set on fire; but Richard Roe concludes that it was struck by lightning. They may both be mistaken, but that does not alter the fact that the building has gone up in fire and smoke. Its destruction is a fact. What John Doe and Richard Roe think regarding the origin of the fire which destroyed it is theory. The former is indubitably true, though the latter may be false. And so it is with evolution and Darwinism. The former is a fact, the latter its attempted explanation.

CHANGE HYPOTHESIS TO GUESS

Third, they take the scientist's word "hypothesis," convert "hypothesis" into "theory" and "theory" into "guess" and then proclaim without shame of their intellectual dishonesty that evolution is nothing but a guess.

The Standard Dictionary defines "hypothesis" as "a state of things assumed as a basis of reasoning, experiment or investigation"; and also as "*loosely and generally*, an unsupported or ill-supported theory." Now it may be possible for a theologian to use the word "loosely" in the second sense, but certainly a scientist never uses it in such a way.

HARRY HIBSCHMAN

Obviously the hypothesis of the scientist is something vastly different from the guess of the layman. It is a reasoned conclusion, based on a comprehensive grasp of scientific facts and laws in the field of knowledge, in which he ventures to formulate it.

A child guesses in which hand its playmate hides a lolly-pop. A scientist finds a new gas on the sun, and he works on the hypothesis that the same gas must exist on the earth. As a result we fill a bag with helium and fly across the continent.

But after all, the best way to settle the question whether evolution is a mere guess or not is to turn to the words of the scientists themselves. They, of all men, can speak with authority on this subject; and their attitude was made a matter of record in a statement adopted in December, 1922, by the council of the American Association for the Advancement of Science, which has a membership of over fourteen thousand—surely worthy of credit and respect in this connection as against the biased misrepresentations of the enemies of science:

"(1) The council of the association affirms that, so far as the scientific evidences of the evolution of plants and animals and man are concerned, there is no ground whatever for the assertion that these evidences constitute a "mere guess." No scientific generalization is more strongly supported by thoroughly tested evidences than is that of organic evolution.

(2) The council of the association affirms that the evidences in favor of the evolution of man are sufficient to convince every scientist of note in the world, and that these evidences are increasing in number and importance every year."

Meaning of Evolution

By DAVID STARR JORDAN

THE general theory of evolution is simple enough. All material objects change with time and space, and these changes are not random but due to definite causes, meanwhile as a whole and in detail following an orderly system.

We have no data on which we can assume that an orderly universe such as ours could exist without an Ordainer. Nor does our mental make-up react favorably to the idea. But of the Infinite Intelligence or Supreme Force different men in different ages have had endless diverging conceptions. A "Creator", to use a very insufficient human word, must certainly be as broad as his works. Infinite traits cannot be expressed in our very finite language, nor can they be understood by our very finite human brain. Hence our duties, towards one another and towards ourselves, which we agree are also our duties towards the Infinite, press upon us more actively and actually than conceptions of Theology, which is the science of what no one knows, nor ever can know in any detail.

Actual students in Evolution are now divisible into three schools, observers, experimenters and philosophers.

ESSENCE OF DARWINISM

The school of observers, with Darwin, depends on what one may see all around him. Darwin himself devoted thirty years to the study of the divergence of species and to the accumulation of all facts which bore on the question. From this source comes, as I have already indicated, the strongest of all lines of argument, the cumulative. The same truth comes up from every quarter, with nowhere a fact which stands in opposition. The essence of Darwinism is that in running the great gauntlet of life, those individuals, men, animals or plants, which proved themselves enduring and adaptable have survived and have left descendents, who inherit more or less perfectly the same traits. Those weak or inadaptable (with many others) perish along the way, and a degree of competition is thus kept up which is the chief moving force of progress. The inherent factors, heredity and variation, keep up a slowly diverging series: no two individuals are ever quite alike, and none diverges very far from its immediate ancestral possibilities.

The whole world, furthermore, is beset by barriers of one sort or another, mountains, seas, climate, food, which break up the mass. In the shelter of a barrier, and under new conditions, new species are moulded, and we do not know of any species which may conceivably have been established in any other way. The formation of races of men, of dialects of speech, of all collective changes of whatever sort, depend on barriers limiting migration.

The school of experimenters work largely in the greenhouse or breeding pen, without as it seems to me, any adequate field of study. Some of them speak of Darwin as a back number. They lay less stress than I think they should on selection and heredity, finding in "mutations" or sudden changes, the chief clue to the origin of species. It is certain that remarkable variations or freaks sometimes arise, and these may often be preserved by heredity. Such variants constitute the basis for the art of selective breeding and their scientific study (genetics) is of the greatest value, but they have little or no place in the actual formation of species. And in no important respect have the charts now in line of completion diverged far from the lines laid down by the master, Darwin.

MAN'S PLACE IN NATURE SECURE

That "Man's Place is in Nature" is so well supported as to leave room for no other inference. Man has certainly arisen by slow degrees from an early mammalian stock. Not from any of the existing types of man-like or anthropoid apes, still less from either of the two very different groups called monkeys. But it is known with reasonable certainty that the earliest man and the earliest anthropoids have had a common origin. Many of the various skeletons recently found in different parts of the world show traits peculiar to man as well as to apes.

In regard to the exact origin of man details are still uncertain. This fact gives rise to sharp differences of opinion. The earlier idea is that some extinct ally of the chimpanzee, apparently an arboreal or tree-inhabiting anthropoid, was ancestral to man. But it may be that man was primarily nomadic, erect in posture, living on the ground, climbing trees when necessary by hugging them; and that his families were held together by common speech or by the prolonged infancy of the young.

While the theory of Organic Evolution is not primarily concerned with man, and questions of his primal ancestry do not affect the main problem—yet man's place in nature remains the same, whatever view we may take as to his actual but still imperfectly known ancestors. In our records of the life of to-day and that of geologic history we find evidence of constant divergence, comparable by analogy to the spreading of the limbs of a tree. Each type shows a constant forward movement—upward or downward—along its own line and never returning. In looking for "missing links," we must go back in mind to find the common stock which preceded divergence. The link between man and apes is not a man-ape nor an ape-man, but some less specialized type which lay behind them both. The nearest approach to it thus far discovered is the Pithecanthropus, but this Java Ape-man is not likely our ancestor, for our lineage is older than he.

NO CONFLICT WITH NOBLEST CONCEPTION

To men of knowledge and honesty there can surely be no permanent conflict between a widening knowledge of the universe, the details of its nature and range, and the noblest conception of man's duty towards his fellow man and himself. The more we know of life and of the world the more surely can we "walk the Earth's crust in adoration," and the more kindly our relation to our fellow beings.

The final decision as to all facts and theories of Organic Evolution must rest finally with experts in Biology. But all branches of science as well as all humanistic studies are already affected and vitalized by it. For it has become plain that no array of knowledge and no line of thought can fail to consider it, and to be influenced by its methods. For behind every phenomenon lies a cause and a history, and to know anything well demands a study of causes and effect and of the details of how it came about. Nothing static exists and to know a thing only as it is is to miss a large part of real understanding. By force of its necessary effectiveness in the pursuit of wisdom, the "method of Darwin" comes each year to occupy a larger and larger part in all phases of human thought.

The Origin of Land Vertebrates

By MAYNARD SHIPLEY

THE geological record shows that there was a very long period of time—millions of years—during which there was not a land animal on earth, excepting spiders, scorpions, centipedes, millipedes, molluscs, crustaceans, worms, and insects. In other words, backboned animals (Vertebrates) inhabited the waters only. (But even the earliest fish possessed, not a true backbone, but only a cartilaginous rod, which later became a truly bony vertebral column.) During an enormous period of the earth's history, then, there were no animals on the earth which possessed lungs, or limbs of bone and flesh.

The earliest fossil remains of vertebrate land animals belong to the period known as the Devonian, the sediments of which were deposited not later than some twenty million years ago. These earliest land forms would, naturally, belong to the Amphibia; for, if evolution is a fact, they would necessarily be derived from some group of fishes.

HOW LUNGS EVOLVED

In order that a land vertebrate should evolve from a fish, the earliest terrestrial inhabitant would have to develop four limbs for land locomotion, and lungs to supply the body with oxygen. Its eggs might continue to be laid in the water—as is the case with the frogs of today. The earliest land vertebrate would naturally be amphibious, living part of the time in the water and part of the time on land. But lungs and limbs do not arise by magic. The lungs of the earliest Amphibians, as also their limbs, were unquestionably derived from some pre-existing organs. Every organ in the body of any animal has some genetic relationship to some older structure in some lower form. Whence, then, lungs?

We should surmise, even *know*, on the evolutionary theory, that there existed in early Devonian time—in the closing epoch of which occurs the oldest known footprint of a land vertebrate (viz., *Thinopus antiquus*)—a group of swamp-inhabiting fishes which supplemented their gill-breathing by air-breathing. And the Devonian strata afford abundant proofs of the correctness of this very logical inference. It can be shown just how the lungs of the Amphibia were derived directly from the air-bladder (or "swimming-bladder") of a gill-and-lung-breathing fish of the early Devonian period.

The fact that there is, in most Fishes, a connection-tube between the air-bladder, the oesophagus (or pharynx), and the mouth, through which air is inhaled and exhaled, leads, in certain cases, to very important results—apart from the ordinary function of the swimming-bladder as an organ used to facilitate rising and sinking in the water. The inhalation of air served to feed the arteries of the walls of the swimming-bladder with oxygen, this organ, in certain groups, serving as a substitute for the gills in times when stagnant water was poisoned with an excess of carbonic acid, arising from decaying vegetable or animal matter in more or less putrid pools. It was observed by Semon, in Australia, that the lung-fish *Neoceratodus fosteri* was able to survive in a partially dried-up water-hole so foul that it was full of dead fish of the ordinary kinds—fish wholly dependent upon gill-breathing. Another genus of lung-fish, of which three species are found in Africa, is able to breathe air still more largely by means of the air-bladder—the sole breathing organ during the dry season.

In both *Protopterus* of Africa and *Lepidosiren* of South America, the swimming-bladder is bilobed, or double, and the walls are developed into pockets, or sacculi, exactly like the lungs of land vertebrates. The entire arrangement of the pulmonary veins and arteries, and of the vascular system in general, is very similar to that of the Amphibia, including the structure of the heart. Even the brain of the African Dipneans resembles that of the Amphibia. The larva of these fish is very much like the tadpole of the frog. Fossil remains of two distinct groups of lung-breathers are abundant in Devonian strata—sediments laid down at a time when the earth's crust was characterized by successive elevations and depressions of land surfaces.

ORIGIN OF LEGS AND ARMS

As to the origin of limbs, we must look for their beginnings in the fins of the early Devonian fishes. Fortunately, we have a striking fossil example of a fin in the process of being transformed into a forelimb. Examination of a Devonian fossil fish known as *Sauripterus taylori* reveals a central hand-like lobe-fin of cartilaginous rods surrounded by a fringe of paddle-like dermal rays. The dropping of this fringe—a modification of the skin—would leave a cartilaginous arm and hand-like structure, already divided into a humerus, radius, ulna, wrist, and several fingers. The shoulder-girdle of this transition type of fish is homologous with that of an Amphibian, part for part—clavicle, supraclavicle, scapula, coracoid.

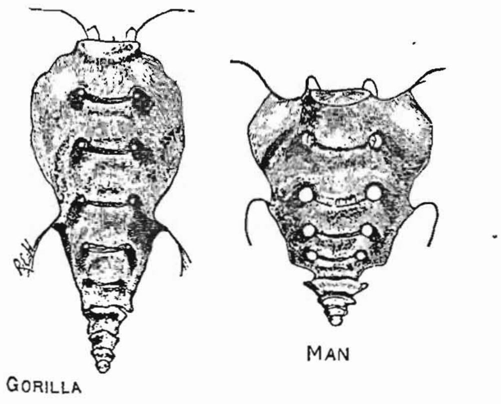
Here, then, we furnish the anti-evolutionist with concrete "links" which are not "missing"!

Man: A Walking Museum of Antiquities

By BERNHARD J. STERN

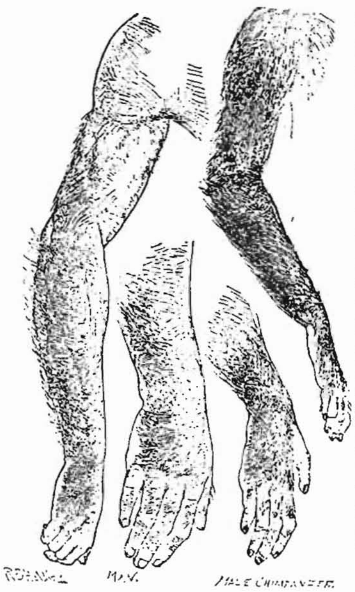
CHARLES DARWIN once aptly remarked that man can scarcely sneer at the theory of evolution without showing under his upturned lip the canine teeth that proclaim his anthropoid relationship. The long canine is considerably abbreviated in man as compared to the gorilla but it is there none the less, indicating his descent. One can acquire wisdom concerning evolution also from man's "wisdom teeth," which are largest among the molars in the gorilla, but which in man offer little or no assistance in mastication. They are "vestiges," relics of man's previous biological form, museum specimens which persist in appearing in modern man.

There are about a hundred of such "vestiges" in the human body, which prove man's affinity with the lower animals; we shall consider only the most obvious of them. Do you remember when you were young, your envy of the boy who could excel in wiggling his ears and how you were spurred to attain some success in such an achievement yourself? You were only making use of the muscles of the external ear, which quadrupeds needed to enable them to move their ears to catch sounds. Man can revolve his head in the direction of the sounds but the muscles of the ear remain in a dwindled condition. Similarly, some of us have seen in circus side shows men who can voluntarily move any part of their skin, and all of us can raise our eyebrows and wrinkle our foreheads. Among our animal ancestors this twitching of the skin was instrumental in ridding them of pestiferous insects.

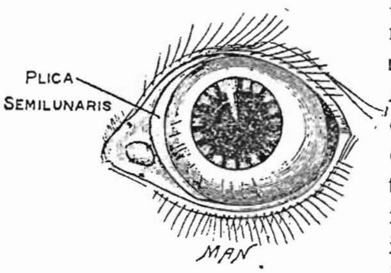


TAIL BONES *

But where is man's tail, asks the anti-evolutionist? The tail is lacking in man as it is among the anthropoids, but rudimentary tail bones remain as part of man's vertebral column, and very often the tail muscles persist in a dwindled condition. Therein lies another tale of man's ancestry. And where is the hairy coat of the ape? It is represented by the short hairs over the body surface of man, at whose roots are functionless muscles similar to those which elevate the hairs of the ape. The conformation of the hair on man's arms is exactly like that on the arms of the ape, where it serves to protect the animal from rain as it sleeps with its hands folded over its head. The collateral relationship of the ape and man is thus strikingly brought out.

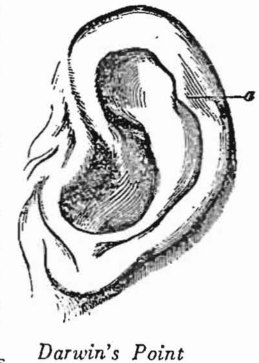


That extremely complicated mechanism, the human eye, cannot be explained except in terms of its evolutionary development. One of the most interesting "vestiges" in the human body is the crescent-shaped fold in the inner corner of the eye, which now serves no purpose. Among the sharks and other of our fish ancestors, this semi-transparent membrane functioned as a third inner eye-lid by sweeping rapidly over the external surface of the eye, perhaps in order to keep the surface clean.



No matter what shape the ears of some men may be they do not approximate the elongated ears of the lower apes, which end in a point. But though the shape and size of man's ears have changed, the tip of the ape's ear is very often represented in the inner fold of the margin of the human ear by what is known as "Darwin's point." He characterized it as "a surviving symbol of the stirring times and dangerous days of man's animal youth."

These vestigial organs in the human body, which make man a walking museum of antiquities, have been compared to the unsounded and therefore functionless letters in words, such as the *o* in "leopard," the *b* in "doubt" and the *g* in "reign." These letters are now of no use, but we learn from them the history of the words. So too, do the vestigial structures reveal man's biological evolutionary history.



Darwin's Point

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*Illustrations for this article taken from Newman's Readings in Evolution, after Romanes.

EVOLUTION

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To combat bigotry and superstition and develop the open mind by popularizing natural science

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NEITHER HIGHBROW NOR LOWBROW

EVOLUTION is not printed for the edification of specialists in science. Plenty of professional journals for that purpose.

Neither does it propose to "convert" fundamentalists. It will not appeal to those that base their opinions upon faith instead of facts.

EVOLUTION is published for the ordinary mortal that would like to know "what it's all about."

Heretofore most of our neighbors haven't bothered their heads much about natural science and evolution. But the tremendous agitation to outlaw evolution that the fundamentalists are now starting will cause a great many laymen to want to know something about it.

So EVOLUTION will be Johnny-on-the-spot, easy to read and easy to understand.

At the same time EVOLUTION will always be strict regarding facts and will merit the respect and support of the most eminent men of science.

ARKANSAS NEXT?

So there's to be a popular referendum on evolution in Arkansas. Fundamentalists boast that they already have over 9,000 of the 12,000 signatures necessary to place the question on the ballot. They'll quickly get the rest.

Now don't make the mistake of cracking jokes of the "Slow Train Through Arkansas" variety. Arkansas is not the home of John Roach Straton or Aimee Semple McPherson. The people of Arkansas stack up fairly well with the average in our U. S. A. What happens there is a pretty good indication of what will happen all over the country unless the facts about natural science are carried direct to the people.

EVOLUTION offers itself for this purpose.

MAN'S BLOOD COUSIN—THE GORILLA

As we expected, the front cover of our first issue, showing Man's Blood Cousin—The Gorilla, caused comment all over the continent. A few who would have been glad to ignore EVOLUTION if we had published a conventionally polite cover were aroused to fury by its powerful challenge, but nearly all the comment was very favorable.

Perhaps the most thoughtful remark was made by Arthur Brisbane in his column in the New York American. Said he:

"EVOLUTION, new magazine, has on the front page a big gorilla labeled "Man's Blood Cousin" . . .

"Nevertheless, the gorilla, although his blood is marvelously like that of human beings, is certainly not man's cousin *mentally*. If he were, he would eat other animals as man does and kill his own kind for glory as man does."

DANGEROUS DOCTRINE

"Why bother with the beliefs of the morons? Evolution goes on just the same."

A comforting view of some professors, seemingly secure behind cloistered walls in their "passionless pursuit of passionless knowledge." But very dangerous doctrine.

Even in the good old days it made a difference what the morons believed, as many a "witch" could testify, gently roasting at the stake.

And today said moron is a sovereign. He may not be able to stop evolution, but he'll surely stop the clock of the evolutionist unless men of science come out of their monastic seclusion and make it part of their business to acquaint their neighbors with what they have learned about man and nature.

The columns of EVOLUTION are at their service.

HE KNOWS, BUT HE WON'T TELL

By EDWIN TENNEY BREWSTER

THE Oracle again utters its voice—and, as usual, gets things precisely wrong.

Somebody asks Reverend S. Parkes Cadman, D. D., the quite reasonable question, "If mankind developed from monkeys, as the evolutionists say . . . at what point in the process did the soul enter into man . . . ?"

Dr. Cadman knows, of course; he just does not want to tell. So he sidesteps with this:

"Will you give me the name of any reputable authority who fathers the assertion that 'mankind developed from monkeys'...? There is no excuse for these misrepresentations wherever a schoolboy's science primer is handy. It is no wonder that religion suffers the scorn of the godless and of secular scholars when its adherents advance such empty rhetoric in its defense."

One does not quite know what, in the bright lexicon of syndicated misinformation, counts as "a schoolboy's science primer," but if one may cite school textbooks, there is Dryer's "High School Geography" (American Book Company, Part I, Page 255). "His (man's) structure indicates descent from ancestors of apelike habits, living in trees, and on fruits."

Or if one tries the schoolboy of a larger growth, there are the two big volumes of "Human Origins," by George Grant MacCurdy, Ph. D., of Yale University (D. Appleton, 1924, Page 299; Vol. 1). "The modification of the human frame for the erect posture could take place only after an extended period of arboreal life . . . The apes . . . have never completely gained erect posture; the complete break with arboreal life was successfully made only by the human precursor . . . "

Hence we see, my children, that we did not, as some ignorant persons suppose, ever have a monkey for an ancestor. He was, to be sure, "a creature of apelike habits living in trees"; and he had "an extended period of arboreal life." But a monkey—certainly not! A whale, perhaps; or an elephant?

Marshaling Ignorance

By JESSE LEE BENNETT

THE intelligent portions of the outside world have been startled by the intensity of feeling displayed by the Fundamentalist forces in America in their fight against "evolution."

How, they have asked, could such a phenomenon develop in a country only one hundred and fifty years away from founders nearly all of whom were rationalists; in a country possessing such educational facilities and such perfection of ways of intercommunication as was never before imagined?

The plans of the men of the revolutionary era were clear. They sought absolute separation of church and state, and universal literacy which would prevent the functioning of the age-old machinery—political or ecclesiastical—for the marshaling and exploitation of ignorance.

ECCLESIASTICISM NOW DOMINATES

When, in the material realm, the development of the United States had transcended all hopes; when, with six per cent. of the population of the earth, it possessed more than half the gold and such wealth as was never before imagined; when its schools, libraries, newspapers, magazines, motion pictures and radio bound the common mind of America together as one unit, the outside world saw the strange phenomenon of ecclesiastical domination of legislative bodies.

What is the explanation of this unexpected development? How has it been possible to marshal and exploit ignorance in a nation possessing universal literacy?

No answer will be offered here but any satisfactory answer would cast brilliant new light on the whole structure of American life.

Jefferson predicted that "the people will lose themselves in the sole faculty of making money." His prophecy has come true. With wealth has come luxury and a totally unjustified sense of enduring and inalienable national security and superiority. The concentration of this wealth, moreover, has permitted a centralized oligarchy to control not only financial and political power but all the agencies for reaching the common mind. It uses these to obscure thought, to standardize, befuddle and misdirect.

In the ecclesiastical field it adopts its old tactics of claiming revealed dogmatic religion as the sole guardian of security, prosperity, virtue, the home and all the other instinctive and unreasoning human hopes and fears. This new success of ecclesiasticism must make Jefferson, Franklin, Washington and Tom Paine turn over in their graves!

Mr. Mencken once declared that the virulence of the Fundamentalist movement was due not to any ethical or aesthetic repugnance to the theory of evolution—but to the over-compensation of an inferiority complex awakened because of inability to understand this theory.

There is somewhere a grain of soundness in this idea. To understand the theory of evolution the mind must first of all be open and it must also have been equipped with some understanding of the basic generalizations underlying each of the natural sciences.

CLOSES THE MIND

Ecclesiasticism of course closes the mind and prevents any realistic understanding of scientific generalizations of any sort.

Enmity is generally the result of ignorance and fear. The savage kills the stranger basically for the same reason that the ignorant man can be made to regard evolution as an enemy of mother, home and heaven. It is the fear and suspicion of the unknown, of the strange, of something making demands on understanding not properly equipped.

If there be any validity to these ideas it must follow that attempts to popularize the theory of evolution are at best only palliative measures; that the basic problem consists in learning how to gain control of the centralized machinery for education and dissemination of facts and ideas so that this machinery can be used to enlighten and not merely to entertain and befuddle.

The huge tribe formed by forty-eight united states differs in size, not in kind, from the small tribes all past history has known. The chief and the medicine man have dominated such tribes for their own purposes. The chiefs and medicine men are beginning to dominate the huge American tribe for their own purposes. That large numbers of ignorant but literate men can be brought to elect legislators sworn to protect Fundamentalism and to prevent the teaching of evolution, that vast numbers of literate but ignorant people are obviously incapable of understanding the theory of evolution is but one indication of the success of these eternal oligarchic aspirations.

ONLY HOPE LIES IN SCIENTISTS

The mere perfecting of devices for reaching the common mind is not enough. The manipulation of these devices must be at least partly controlled by scientists. So long as scientists remain immured and blind to this social responsibility; so long as they fail to assume their proper place in the political realm; so long as they make no conscious and deliberate attempts to diffuse to the great masses of the people the information of which they are custodians, efforts to popularize evolution or to spread knowledge of any sort can hope only for minor, and possibly, ever decreasing effectiveness.

The hope of the future lies with the scientist. Will he become an active instead of a passive force in our common life? Will he indefinitely permit the marshaling of ignorance or will he justify his existence by assuming his proper place as the guide of the modern world?

ANOTHER TENNESSEE CASE?

Just as we go to press we learn that J. H. Tate, principal of the Farragut school, ten miles from Knoxville, Tennessee, is under fire because he gave a definition of evolution in one of his classes.

The case promises to be interesting since Tate himself is said to be a fundamentalist, superintendent of the Sunday School and deacon of the Grass Valley Baptist Church. But he seems to be a wee bit open-minded, so the "leading citizens" of that burg are after his scalp.

How Old is the World?

By ALLAN STRONG BROMS

Some Fundamentalist Versions

JAMES USHER, Archbishop of Armagh, set the date of creation in the year 4004 B. C. Dr. John Lightfoot, Vice-Chancellor of Cambridge University, "improved" this dating by fixing the week of creation for October 18th to 24th, so that Sunday, the 25th, became the first day of hard earned rest. But later scholars, of equal "authority", have placed the date variously at 4710 B. C. and 5872 B. C. So, after all, the doctors of divinity disagree and we may, without offense, consider

Some Scientific Versions

In a rear storeroom of the American Museum of Natural History in New York, I was one day privileged to examine a collection of banded clays carefully preserved with glycerine in long metal pans. From them, Dr. Chester A. Reeds and other scientists were reconstructing the history of the New Jersey, New York and New England areas at the close of the Great Ice Age, long before the coming of the white man. They already had a complete year by year record covering thousands of years, indicating a date for the melting away of the ice sheet perhaps more than ten thousand years ago, but so far not definitely connected with modern dates. One of them, Dr. E. Antevs, was, however, busily gathering samples of clay from Canada for that very purpose. He was trying to fix definite dates for the various stages of melting and retreat of the ice sheet which once covered nearly all Canada and much of the northern United States.

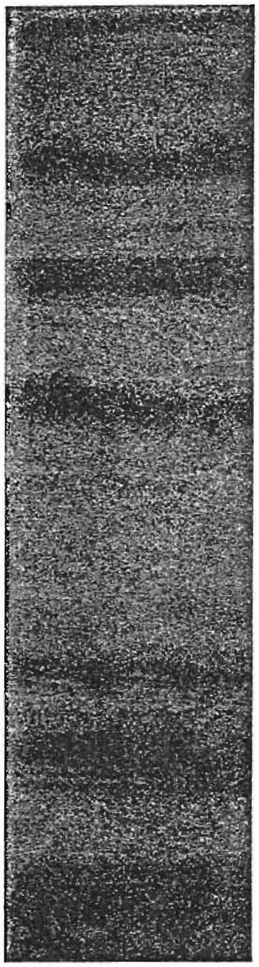
His hopes of success rested upon a previous success elsewhere. He had assisted Baron Gerard De Geer, the Swedish geologist, in applying a new method for finding the dates of retreat of the Baltic Ice Sheet which had invaded the Scandinavian countries, Finland and parts of Germany and Russia. They had fixed dates as early as 11,600 B. C. and connected them definitely with our own calendar dates.

When the long cold spell which caused the Great Ice Age came to an end, the edge of the ice sheet melted back as though retreating. Here and there along its front, pools and lakes of icy water would form. These waters of melting would be muddy with silts and gravels. During the warm summers, when melting was rapid, the swift flow of waters would carry away the finer silts, but let the coarser gravels settle in the lake bottoms.

LIKE THE RINGS IN A TREE

When the cold of winter stopped the melting, the flow of waters would slacken and permit the finer silts to settle slowly and form a dense layer of darker clay. Each passing year would therefore be marked by two alternating layers of gravel and clay, each pair being a yearly cycle or "varve". The principle is exactly the same as that by which we measure the age of a tree by the number of rings of growth.

THE GREAT CLAY CALENDAR



Banded Glacial Clay From New Haven, Conn. Collected by Dr. E. Antevs

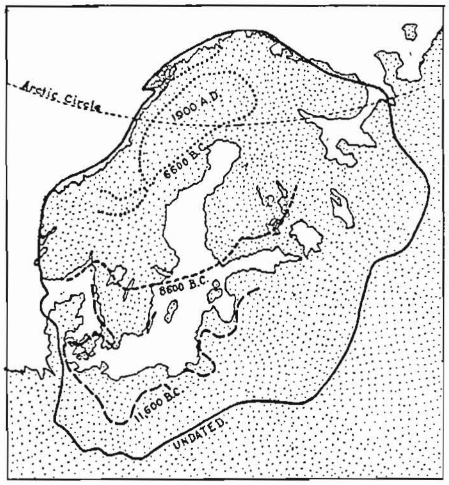
Fortunately the layers are not all alike, but can be positively distinguished and identified over wide areas. During an exceptionally warm summer, a deeper gravel layer might be formed or other distinctive variations appear. The annual deposits in one lake can thus be identified with those in other lakes nearby and by going from one to another, a complete series for thousands of years may be worked out. In fact, they have been traced to the very fronts of existing glaciers in northern Sweden (where just such layers are now being laid down each year), and so connected with our own times.

Obviously, no layer could be formed at any point until the ice had melted from the region. The edge of a layer of any date, where it touches bedrock, will therefore mark the edge of the ice sheet at that date. By this method, the stages of retreat of the Baltic Ice Sheet have been carefully dated as shown on the map. The entire record goes back some 13,500 years, long before the Fundamentalist's date of creation.

PLENTY OF YEARS FOR EVOLUTION

But more than this, the ice sheets must have required tens of thousands of years to accumulate, for they were probably a mile thick in places. Furthermore, the geologic records show that there have been many such ice invasions, separated by periods of warmth as long or longer than our own. So we may safely assume, for the Ice Age as a whole, not merely tens, but hundreds of thousands of years. Nor is this all, for underneath the rubbish left by the melting ice sheets, which is really very thin upon the deep earth crust, are records indicating an earth age of millions of years. At least we may be satisfied that there is no poverty of years for the slow evolution of life upon the earth.

(In our next issue Mr. Broms will explain how scientists measure the age of the earth from the radio activity of uranium and thorium.)



Retreat of glacial ice sheet

DOES SUCCESS BREED CHILDREN?

THE loud wailing set up by eugenists to the effect that people with the best minds tend to have the fewest children, while the most ignorant reproduce most abundantly, ought to be toned down a little, according to Dr. Frederick Adams Woods, formerly professor of biology at Massachusetts Institute of Technology.

At least, he says, among college graduates who have been out of Harvard University for twenty-five years or more, it is the successes who have the most children. He took as an arbitrary measure of success a place in *Who's Who in America.* Dr. Woods found that 25.5 per cent. of the parents with four or more children in the class of 1894 were listed in *Who's Who.*

FUNNYMENTALS

"Better wipe out all the schools than undermine the belief in the Bible by permitting the teaching of evolution."

—The Rev. John Roach Straton, D.D., Calvary Baptist Church, New York.

"Take the evolutionists, infidels and no-hell teachers out somewhere and crucify them, head downward, and we will have a better country to live in and, instead of these evolution and easy way ideas, teach people the Word of God to go by, and all will be well."

—Correspondent of Greensboro Daily News. Quoted by Sprading.

"Worse than an assassin who kills the body is he who shatters the faith of youth."

—Kansas City Preacher at Christian Endeavor Convention, Denver.

"In another two years, from Maine to California and from the Great Lakes to the Gulf, there will be lighted in this country countless bonfires, devouring those damnable and detestable books on evolution."

—Edward Young Clarke of the Supreme Kingdom quoted by The Post of Birmingham, Ala.

"The doctrine of Charles Darwin, in porportion as it dominates the future, the biological theory of evolution to the extent of its final acceptance, will make the recent baptism of blood, brought on by Nietzsche and Treitschke under the domination of that biological theory, as compared with the baptism yet to come, as a local shower to the flood that will prevail over every mountain."

—W. B. Riley, in The Theory of Evolution,

"The consensus of scholarship can go to hell for all I care."

—Billy Sunday in sermon.

"Evolution is in no sense a science, but is instead an irreligious philosophy of creation and all existences, and its teaching in tax-supported schools is absolutely contrary to both the spirit and language of the United States constitution and of the several state constitutions as well; on the ground that the Bible was banished from the public schools because it taught a distinct religion, so should all Christian and even all fairminded citizens now demand that the Darwin philosophy, by nature and constitution agnostic and atheistic, shall be at once and forever removed from our tax supported schools and no advocate of the same be permitted to voice himself before the students upon the same."

—From resolution adopted by Worlds Christian Fundamentals Association at its convention in Atlanta in 1927.

"Take a jackass, a hog and a skunk and tie them together and you have a scientific evolutionist or modernist."

—Rev. Charles F. Bluske, of Asheville, quoted in The American Mercury.

EVOLUTION IN SOUTH CAROLINA

By ROBERT F. HESTER

WITHIN the past few months, two university professors have been ousted from their positions in South Carolina educational institutions because of their pro-evolutionary leanings. One was a Professor Pickens, of Furman University, Greenville, S. C., and the other Prof. William G. Burgin, professor of sociology at Winthrop College, Rock Hill, S. C. The fact of chief significance in connection with the latter was that the decision of the college against him was at the last unfavorably influenced by Gov. John G. Richards of South Carolina. Both men had enjoyed excellent records at the institutions previous to their announcements of their evolutionary tendencies.

But this apparently weighed little with Governor Richards. In his inaugural address, it is reported that he made it plain that no man or woman who did not implicitly accept the story of creation as told in Genesis should be tolerated in educational institutions supported in whole or in part by state funds. In a statement subsequently published in a Columbia newspaper, he declared that "any person or persons who are discovered to be antagonistic toward the Christian religion or the Bible, either the Old Testament or the New," would be rooted out of the schools of the state.

The ultimate destiny of South Carolina under such executives is rather difficult to predict. The whole matter hinges upon the question as to whether or not the State's population as a whole has or exercises more brains than its chief executives. If it has not, then its destiny may be safely predicted—it will become, if not the most criminal, at least the most ridiculous state in the American Union.

Nor is Richards the first governor of this state who has upheld fundamentalism and opposed even a slight tendency to the acceptance of evolution among its teachers. Former Gov. Cole L. Blease once advocated the strict examination of all prospective teachers as to their religious beliefs before their admission into South Carolina's schools and colleges. If their beliefs should thus be found to be in any sense antagonistic to the fundamentalists' creed, he recommended in strong terms that they should be harred from the state's educational institutions. And this same fellow was thereafter elected to the Senate of the United States.

So long as these conditions obtain in South Carolina, the state can hardly defend itself against the ridicule and derision of civilization.

CO-OPERATE BY CLIPPING

Readers are invited to send clippings of news and articles that they consider interesting, being sure to give date and name of publication from which taken.

SHARES AVAILABLE

The EVOLUTION PUBLISHING CORPORATION, organized under New York State laws, offers its $10.00 shares of 6% preferred stock. With every five shares of preferred one $10.00 share of common, voting stock will be given.

The immediate business is publishing this journal, EVOLUTION and selling books. Later a Lyceum Bureau for touring natural science lecturers will be developed.

Although it is expected the business will pay, share-holders are not invited on the basis of making profits, but because this work is WORTH DOING.

Additional capital furnished now will help make the circulation campaign for EVOLUTION magazine a success. Checks should be made payable to EVOLUTION PUBLISHING CORPORATION. In remitting kindly state whether payment is made in full, or whether it should be applied on a larger block of stock to be held until the balance is paid.

LET US MAIL SAMPLES TO YOUR FRIENDS

Of course you'll show this issue of EVOLUTION to your friends and ask them to subscribe. But you probably know some who would be interested, whom you can not visit yourself. Send us their names and addresses and we'll mail them sample copies.

It will cost us about five cents a copy to send out these samples, so if you can send along a check to help pay for them we'll not object. However, if your bank account is minus don't let that stop you. Send us the names anyway and we'll raise the cash otherwise.

WHAT'S A HUNTER WITHOUT AMMUNITION?

A hunter without ammunition is in the same fix as an evolutionist without copies of EVOLUTION. Surely YOU don't want to remain in such a pickle. The best way out is for you to fill in appropriate characters on the following blank in a hurry.

— — — — — — — — —

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THE MONKEY AND THE MOVIE

By ALBERT J. INGALLS

HOW would monkeys and apes react to motion pictures of other monkeys and apes? To test this point a motion picture called "The Gorilla" was shown recently in the monkey house of the New York Zoo. Several scientists observed the caged anthropoids during the show.

The monkeys virtually ignored the picture, even when the "gorilla" appeared. But an ape, "Bessie," a half-grown female chimpanzee, watched the entire show.

After Kohts and C. K. Ogden.

Chimpanzee Laughing

She curled herself up comfortably and made an evening of it. Never once did her eyes leave the screen. Her interest was uniformly keen, but she revealed no sign of emotion. Her eyes shone throughout, and followed each entrance and departure of an actor. What she thought, what the comings and goings of the actors meant to her, if they meant anything at all, I do not know. But she seemed to take in the movies just about the same as anyone else would.

The chimpanzee's intelligence is about on a par, in some ways, with that of a child of four or five. The gibbon, the orang and the gorilla are classed with the chimpanzee, making a family called the simians. These four apes stand closer to the human being both in body and mind than to the large group of primates commonly called monkeys, and their intelligence is far above that of the monkeys.

Those interested in the mentality of apes will find much food for thought in Yerkes and Leonard's "Chimpanzee Intelligence and Its Facial Expression"; also in Robert Yerkes' "Almost Human" and Professor Koehler's "Mentality of Apes." In the March, 1927, issue of *The Quarterly Journal of Biology* (Baltimore, Md.) there was a long article on "Anthropoid Behavior" by Robert M. Yerkes and Margaret Child. Incidentally, this article contains a complete bibliography of the entire subject of anthropoid ape behavior.

MEET OUR CARTOONIST: NATE COLLIER

Many readers will want to know something about the artist who created the clever cartoon on the back page of this issue. The following, by Nate Himself, in January *Art and Life*, elucidates.

MY AUTOBIOGRAPHY

Born at the age of sixteen one Wednesday morning of the afternoon of Friday, somewhere during the ides of March in December, according to Hoyle, in the year of the big wind about 1648, Anno Dominoes or Before Christ, I forget which.

Graduated from Heidelberg in 1661.

Shipped on the good ship Wiffempooff, 1662, for first cruise around Cape Horn.

Assassinated by boomerang thrower in Australia, 1663.

Collaborated with Victor Hugo in writing "Memoirs of a Goldfish," 1670.

Built Trans-Siberian Railway, 1741.

Wrote Grays Elegy in Country Churchyard, 1750.

Discovered Kippered Herring, 1760.

Founded Society for Prevention of Cruelty to Sardines, 1800.

Married Cleopatra, 1802.

Pitched for Giants, 1813 to 1842.

Married Carrie Nation, 1856.

Wrote Gullivers Travels, 1858.

Married Joan d' Arc, 1859.

Joined Brigham Young's Mormon Invasion of Utah, 1865.

Discovered North Pole, 1872.

Invented Non-skid Pancakes, 1873.

Wrote "The Love-Life of a Cheese Sandwich", 1880.

Emigrated to Poland, 1883, and started Coca-Cola Rebellion.

Invented Cross Word Puzzles, 1925.

And am still apparently a young man in my early seventies, with a long life before me. (Signed) NATE COLLIER.

After Koehler and C. K. Ogden.

Yes—We Got the Bananas

SCIENCE SERVICE

THOSE who wish to keep in touch with current scientific progress throughout the world, but who have not the time to read the technical publications, are recommended to investigate Science Service. This organization, founded some years ago by the late E. W. Scripps, interprets to the non-technical public the work which technical men are doing, but are often unable to tell about in language which the layman can understand.

From its office in Washington, D. C., it mails to newspapers subscribing to its service a daily *Science News Bulletin* summarizing current science news. It also furnishes a telegraphic service covering "spot news" of new inventions and discoveries, earthquakes, comets, explorations, and so forth. A weekly feature service also is sold to newspapers and a number of other features covering various phases of science.

To the individual layman, however, its most interesting service is the *Science News-Letter*, a weekly magazine, using Science Service newspaper feature material, with the addition of book reviews and other features. A full description of Science Service features may be had by writing to that organization at B and Twenty-first Streets, Washington, D. C.

SYNTHETIC FOOD

PROF. E. C. C. BALY of the University of Liverpool has made up his mind he is going to manufacture food synthetically and thus transfer the farm to the laboratory. In his experiments he is trying to imitate the process by which plants turn carbon, hydrogen and oxygen into that chemical combination known as sugar, and later changed for storage purposes into starch.

After years of research he believes he is approaching this secret. By suspending finely powdered carbonate of nickel or cobalt in water containing carbon dioxide gas and exposing this to sunlight, sugar is produced. While the process is not the same as that which takes place in connection with the chlorophyll in plants, Professor Baly believes he is on the road to discovering one of the fundamental secrets of nature.

After all, all life depends upon this process. There are some animals that live on other animals, but most of those eaten as prey live upon plant life.

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I'll stake you to a dollar's worth of EVOLUTION, twenty copies, if you'll write me right away for I know they'll sell like hot cakes at your first meeting. Address: Katterfeld, c|o EVOLUTION.

CREATION, A HISTORY OF NON-EVOLUTIONARY THEORIES. By *Edwin Tenney Brewster.* Bobbs-Merrill Co.: $3.50.

This is a scholarly book in the best sense. It is careful of its facts and presents them without prejudice. But if by "scholarly" you mean dry and difficult, it is anything but that.

It purports to deal with non-evolutionary theories only, and precisely because it does so, it fills a gap in our literature of evolution. It gives the background for the evolution of evolution. Heretofore the histories have stuck much too closely to the subject. They have told of the pioneers of evolution from the Greeks to Darwin, but never so clearly of the forcing of the mind to accept evolution over other theories because the facts decreed. As you read this book and note the successive yieldings of inadequate theories to inexorable facts, you realize how very significant the evolution theory is, how well it explains, how completely the evidence supports it and why the scientific world so unreservedly accepts and uses it. The book is most convincing.

It supplies ammunition. It enumerates those difficult facts which the anti-evolutionist can never explain. It is literally loaded with "posers." The militant evolutionist will certainly delight in it. I am afraid he will even laugh with joy as he reads it. He will probably tuck it under his gun arm and start right out stalking Fundamentalists. A. S. B.

THE OUTLINE OF MAN'S KNOWLEDGE. By *Clement Wood.* 728 Pages. Published by Lewis Copeland Co.: $5.00.

Clement Wood, fitted for his task by many years of study, has presented his story in "The Outline of Man's Knowledge" with the painstaking accuracy of a scientist and the imaginative vision of a poet. In his hands, the vast accumulated knowledge of five million years becomes fascinating narrative. The reader is made the master, not of segments of unrelated knowledge but of knowledge as an evolving and related whole, and as he reads he comes alive in the fullest sense to the scheme of things.

Earth began. Life arose, people developed. Over the vast scattered surface of the globe different people rose to separate and distinct achievements, went forward to diverse destinies. The long reach from tribal life and instruments of stone to the complicated age of airplane and the hectic ticker tape, rivals in interest one's favorite novel. The maps of Ilonka Karasz and the decorations by Louis Bromberg decidedly increase the value of this guide to education.

History, Philosophy, Physics, Poetry, Drama, Painting, Sculpture, Astronomy, Biology, Psychology, Mathematics, Sociology, Literature, Architecture, Religion, Music—the important facts that have been learned since the beginning of history are presented here in untechnical language that not only everyone can understand, but can enjoy. In perfecting the various sections. Mr. Wood has had the advantage of suggestions from, and cooperation with, the best minds in each department. Professor James Harvey Robinson, Meade Minnigerode, Gamaliel Bradford, John Sloan, Professor John Dewey and Dr. Fagnani are some of the names cited by Mr. Wood in his acknowledgment.—JOSEPHINE HERBST.

THE BEST BOOK ON EVOLUTION

A number of readers have asked "What is the best book on evolution for a friend who is not a scientist?"

To all such I recommend unhesitatingly "Evolution for John Doe," by Henshaw Ward. It is the most interesting and convincing book of which I know. Its contents include:

Part One: A Description of Evolution.

1. What John Doe Thinks About Evolution.
2. The Myriad Forms of Life.
3. The Tangled Web of Life.
4. The Varied Modes of Life.
5. The Jungle of Adaptations.
6. The Struggle for Existence.
7. Variation.
8. Heredity.
9. Natural Selection.

Part Two: The Evidences of Evolution.

10. What Evidences Are.
11. Evidence from Rivalry of Scientists.
12. Evidence from the Rocks.
13. Evidence from Geographical Distribution.
14. Evidence from Classification.
15. Evidence from Artificial Selection.
16. Evidence from Structures of Animals.
17. Evidence from Embryos.
18. Evidence from Blood.

Part Three: The History of Evolution.

19. Lamarck.
20. Darwin.
21. Weismann.
22. Mendelism.
23. DeVries's Mutations.
24. How Evolution Stands Today.
25. The Fosdick Idea. L. E. K.

RECEIVED FOR REVIEW

CHARLES DARWIN: THE MAN AND HIS WARFARE. By Henshaw Ward. Published by Bobbs Merrill. $5.00.

THE MILLENIUM AND MEDICAL SCIENCE. By David N. Schaffer. Published by the Author. $2.00.

ALL SOLD OUT

Meadow's news stand, Forty-second St. and Sixth Ave., New York, re-ordered twice. Sold over 100 copies.

The A. A. A. A., 119 E. 14th St., N. Y., sold 145.

So many second orders were received for our first issue that we haven't any left at the office. If anyone has unsold copies remaining, we will be very glad to send postage for their return.

A PRAYER

O, would that evolution
Could change the convolution
Of the Fundamentalist brain;
Create a sense of humor
To replace the deadly tumor—
That causes him such pain.
—BOB LYLE.

HERE ARE SOME GOOD BOOKS

EVERY reader of EVOLUTION is *of course* also a reader of books. We recommend the following in their respective fields.

The commission we receive on book sales will help to broadcast EVOLUTION, but we'll share it with you.

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From Our Readers

"I shall not subscribe. I object to your using such a weapon as making 'fun'." Emily N. Wilson, New York.

"Oh, boy, what a kick it carries." J. L. Sullivan, Ohio.

"Received sample. Thank you. I hope to see the day when EVOLUTION will have one million subscribers and wish you every success in your new venture. Inclosed please find my check for $4.00 for six subscriptions and $1.00 for Broadcasting Fund." David N. Schaffer, Ill.

"Send me a hundred or so. Can handle 200." H. H. Stallard, Oregon.

"Just received your nice magazine EVOLUTION. To say we were delighted would be putting it mild. I hasten to enclose $3.00 for J. O. Beebe and two friends. I wish you success." Mrs. J. O. Beebe, Cal.

"EVOLUTION looks good. Here's hoping it helps us all lose our tails." Solon DeLeon, N. Y.

"I would feel disposed to support your journal except that you have taken occasion to make use of ridicule of fundamentalism and I feel that it is a pity that you should stoop so low in work for a high cause." C. P. Wilson, California.

"A friend loaned me Number One of EVOLUTION, and I found the excerpts from our fundamentalist friends so exhilarating that I want to subscribe. Here is the dollar." S. H. Gage, New York.

"If you are going to keep up the excellent type of articles which appear in this No. 1, I want it regularly. I am enclosing my cheque for one year in advance." G. Bacon Price, California.

"Hearty congratulations on the first number of EVOLUTION. Enclosed find $2.00. Wish you success in this much needed publication." Edward M. Kimble, Canada.

"We wish to congratulate you on this splendid journal and feel sure that with the great need there is for this type of paper that it will quickly become a leader among the liberal press in fighting the shams and hypocrisy of fundamentalism." Zachariah Wingate, Missouri.

"I'm delighted with it." H. J. Stuart, Alabama.

"The magazine is good and is bound to have a large circulation. Send us 350 copies as sample copies to our agents. We are sure they will get a number of subscriptions." Martin M. Attila, Wis.

"I hope you will not only defend evolution but counter attack those that are assailing it." Homer H. Wakefield, N. Y.

"The journal will certainly fill a long felt want. I trust it will not be too blatant. If the editorial "Our Policy" is adhered to, it will not. The front page is 'great.' Franklin C. Smith, New Jersey.

"I think this is a most unfortunate publication from the standpoint of those who are primarily interested in disseminating trustworthy information about evolution in a form calculated to win adherence rather than stimulate antagonism.

"I am not alone in this feeling for I have received both letters and telephone calls asking whether I have seen your publication and expressing disgust with it." C. Stuart Cager, New York.

"I have just received the first number of your paper, EVOLUTION, and am very greatly pleased with it. I should like to give it a good notice in the next number of the *Quarterly Review of Biology*. Will you not be willing to let me reproduce in this review the cartoon on page 9 of your first issue." Raymond Pearl, Md.

"Best wishes. Well started. Should reach everybody because everybody needs it. Enclosed $1.00." Dr. Nicholas A. Karpoty, California.

"I want no discount. I am anxious for your journal to succeed. I'm sending you separately my own plea for science: 'Bible in the Public Schools'." M. Mark, Indiana.

"One of my friends sent me your magazine EVOLUTION and I am highly elated with its policy and inclose my dollar." Henry Gerber, New York.

"I like your magazine very much. The first number is quite striking." Adeline F. Schively, New Mexico.

"Best wishes for your success. It's a good thing. Enclosed $2.00." Marcus Dezee, New York.

"Kindly send twenty copies of EVOLUTION *every month.* We will boost your publication as much as possible, as our labor organizations are also interested in spreading the evolution idea." Max Hahne, Naturfreunde, New York.

"I wish that you send me 20 more. The first 20 were sold faster than I thought." J. Berger, Wisconsin.

"I wish you all success in your work against obscurantism. It requires uncompromising and fearless fighting all along the line." James F. Morton, New Jersey.

"Mighty glad to have a copy of EVOLUTION. I read it through last night and like it fine. You ought to have a million readers, and I predict you will get them, as the magaine has a popular appeal and is needed." Guy Lockwood, Michigan.

"As a hobo who is more or less literate I have come across your delectable magazine. It literally knocks the metaphysical props from under our fundamentalists. Go to it old boy, and construct a real scientific, and yet sarcastic and humorous classic. Watch the sky-pilots jump at your venture. But let them gyrate and howl. You are destined to acquire a vast audience. Wish you luck." Daniel F. O'Brien, New York.

WHAT OF IT?

I see no use evading
The charge of monkey blood;
Is it less degrading
To say we sprang from MUD?
—BOB LYLE.

"The first issue, in the light of what it is attempting to do, is excellent. I only hope it will reach the fundamentalists, but more than that, will reach many of those still on the fence and convert them to the evolutionary point of view." V. F. Calverton, Maryland.

"I like your little periodical. Your lineup of contributors suits me immensely. Enclose check for $3.75." Herbert English, California.

"Your first number pleases me very much. You have started a publication of a kind which has seemed very greatly needed. I wish very deeply for the success of your undertaking. Enclose check for $5.00." A. H. Candee, New York.

"Send me ten more copies. I'll put EVOLUTION in my rack alongside 'True Story' and give my customers an opportunity to practice natural selection." Ben Bavly, Michigan.

"You have a galaxy of contributors whose writings all thinking people should read." J. Arthur Eddy, Colorado.

"The magazine is small, but contains more worthwhile reading matter than many another magazine four times as large. The undertaking is wise and timely and I firmly believe that this journal will soon be a real menace to the fundamentalist movement. It deserves the support of every freethinking man and woman." J. Koenig, New Jersey.

"I enclose check for twenty subscriptions to EVOLUTION to be sent to my address. I don't want my name mentioned. The copies subscribed for will be sold at the Unitarian Church here." A friend from California.

"Despicable. Obscene. Unspeakably vile. It ought to be suppressed." A lady who called at our office but refused to tell her name.

"The magazine is well balanced and covers many angles of the question. The cover is calculated to infuriate the rabid apostles of fundamentalism It is an excellent photo of a male gorilla and bears the scientifically correct caption, 'Man's Blood Cousin—The Gorilla.' Such a magazine certainly deserves broad support from those who perceive the growing menace of legislation placed upon the statute books by the ignoramuses of the bible belt." H. M. Wicks, in The Daily Worker, New York.

"I must refuse to write for a publication with such a provocative title as EVOLUTION." (In interview) Ben C. Gruenberg, New York.

"Good for you, old scout. Count me in." Bruce Rogers, New York.

Honor Roll

THE following friends constitute the EVOLUTION Honor Roll for this month, having paid for the number of subscriptions indicated since last report. If the splendid example set by these friends of academic freedom is followed generally by our readers EVOLUTION will soon be a power in the land. Will you join this goodly band by sending in at least three new subscribers THIS month?

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EVOLUTION BROADCASTING FUND

HERE are the EVOLUTION BROADCASTERS for this month. Each one of these supporters has contributed to our Broadcasting Fund. This made possible the sending of several thousand samples of our first issue to prospective readers.

Every month we want to broadcast at least 5,000 copies to secure new readers. It costs about 5 cents a copy to do this. Since EVOLUTION has very little capital, we ask our friends to help with this work. Samples will be mailed to at least twenty addresses for every dollar received for our Broadcasting Fund.

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If you have no library, put the "Outline of Man's Knowledge" upon the mantle shelf and you have a very considerable one. Clement Wood, biographer, historian, poet and scientist, has condensed more knowledge into one single volume in his "Outline of Man's Knowledge" than one can find in any book within our recollection. And he has written with a sense of proportion and an accuracy which makes his illuminating volume the best book for self education available anywhere.

Zona Gale:
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CHEER
AND certainly I do
hereby wish unto you
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BERT RUSSELL
Patent Attorney
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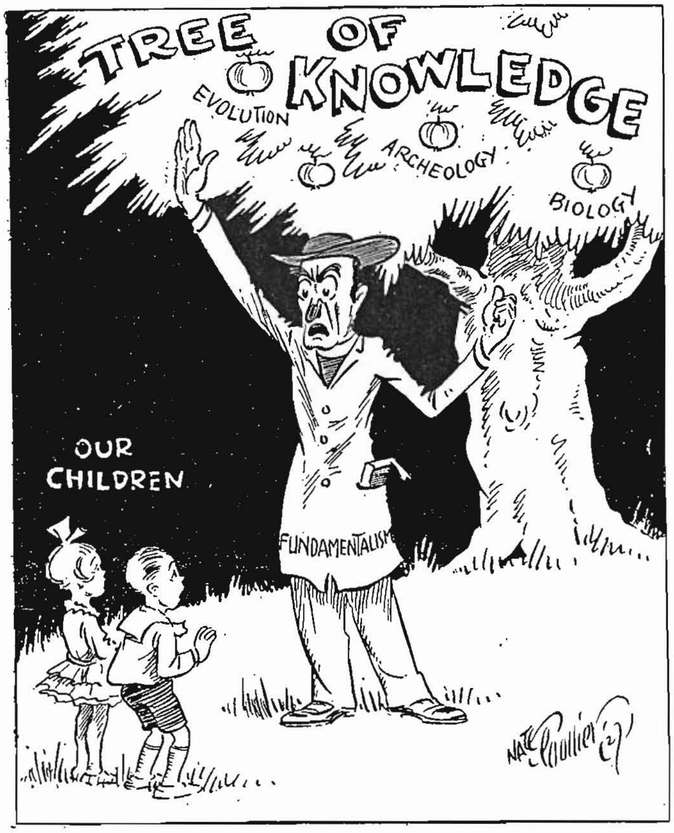

CONTRIBUTORS TO THIS ISSUE.

JESSE LEE BENNETT: Editor *The Modern World*; Author of "Frontiers of Knowledge"

EDWIN TENNEY BREWSTER: Author of "Creation, a History of Non-evolutionary Theories."

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ALBERT J. INGALLS: Associate editor of *The Scientific American.*

DAVID STARR JORDAN: President Emeritus Leland Stanford University. Author "The Higher Foolishness."

MAYNARD SHIPLEY: President, Science League of America; Author of "War on Modern Science."

BERNARD J. STERN: Department of Sociology, University of Washington. Author "Social Factors in Medical Progress."

THOU SHALT NOT

growled some old mossback in the trees, when our most venturesome ancestor first tried to stand on his hind legs and raise his gaze toward the stars.

Thou shalt not eat of the tree of knowledge has been the command of fundamentalism down all the ages. Thou Shalt Not—to Newton weighing worlds,—to Copernicus measuring universes. Thou Shalt Not—to Galileo,—to Harvey,—to Darwin deciphering the book of nature with infinite care.

And Thou Shalt Not is the fundamentalist command today to every earnest student, to every courageous teacher of facts. Militant and rampant, fundamentalism wants to make this

THE LAW OF THE LAND

as it is already in Mississippi and Tennessee.

Had science in the past obeyed the fundamentalist command, the pall of the Dark Ages would still smother the world and modern civilization would have remained a dream undreamt. Neither shall we tamely submit to the menace of fundamentalism today.

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THOU SHALT

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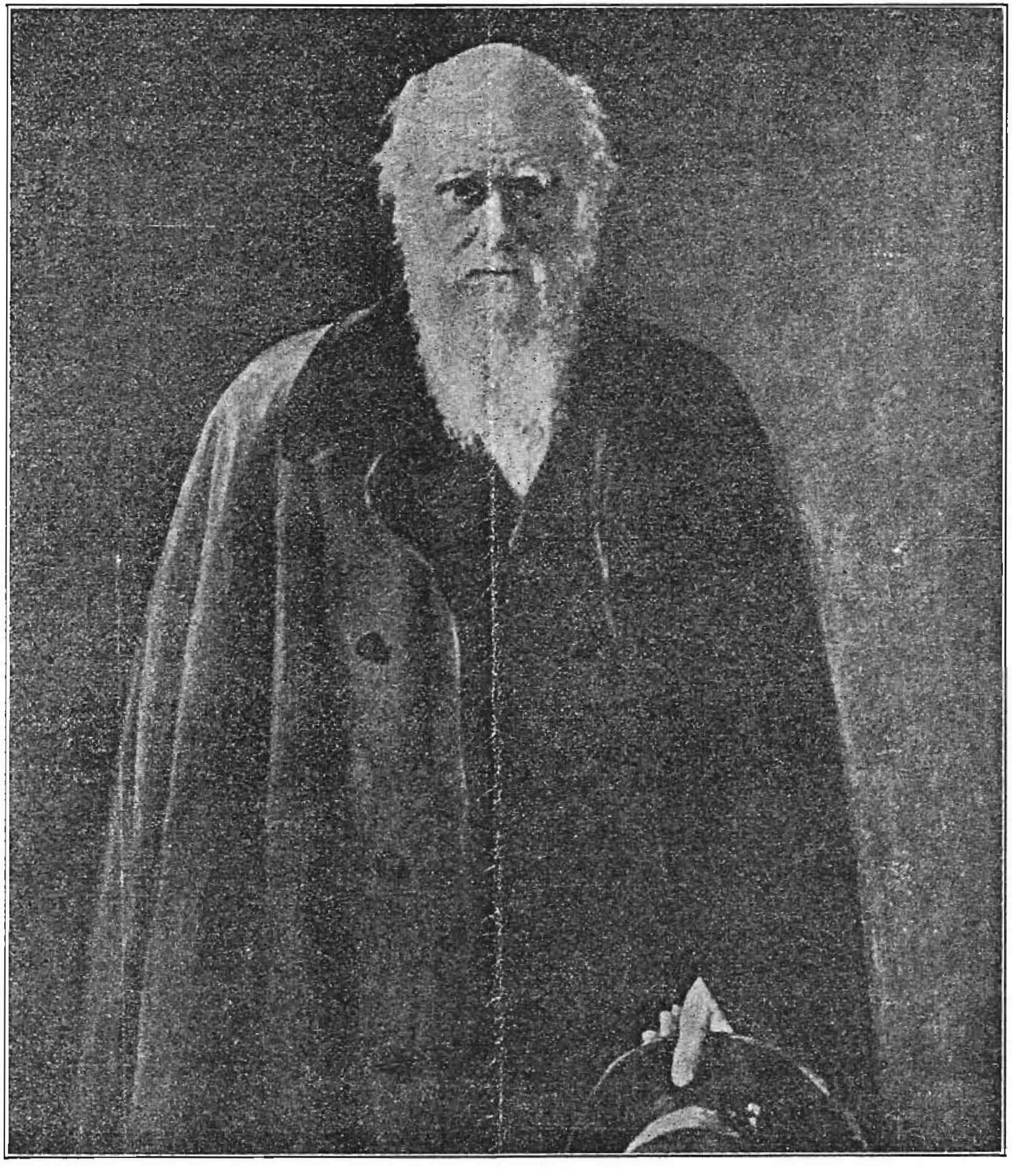


Courtesy of National Portrait Gallery, London, and Bobbs-Merrill Company

THE GREAT EMANCIPATOR OF THE HUMAN INTELLECT

CHARLES DARWIN Born February 12, 1809

How Charles Darwin and Alfred A. Wallace Discovered Evolution

By ALEXANDER GOLDENWEISER

ON the 18th of June, 1858, Charles Darwin received a letter from Alfred Russell Wallace, then naturalizing in far-away lands. The letter contained a paper by Wallace "On the Tendency of Varieties to Depart Indefinitely from the Original Type." On the same day Darwin wrote to his friend Lyell, the geologist, expressing the fear that he, Darwin, had been "forestalled".

The fact of the matter was that Darwin himself had for years been interested in the problem the solution of which had come to Wallace in a moment's "flash of insight". And Wallace's flash corresponded to Darwin's own—he also had thought of "natural selection" as the process by means of which new species arose.

Now Darwin was in a quandary. He hesitated to publish, fearing unfairness to Wallace, but he was not indifferent to the prestige and fame which his own findings deserved and were certain to earn. Finally he was prevailed upon by his frinds, Lyell, Hooker, the botanist, and Huxley, the biologist, to have both papers presented at a meeting of the Linnaean Society. On July 1st. 1858, a report was read to the Society by its Secretary consisting of Wallace's paper, an extract from Darwin's sketch written in 1844—thus definitely establishing his priority—and part of Darwin's letter to Asa Grey, the naturalist, written in 1857.

The theory of natural selection was launched on its path which was to prove thorny but ultimately triumphant. Darwin went to work at once on his book which was finally offered to the public on November 24th, 1859, under the title "The Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life". The full data embodying the results of Darwin's painstaking investigations were not published until eight years later (1868) in his two volume work on "The Variation of Animals and Plants under Domestication". Finally in 1871 Darwin followed this up with his "Descent of Man" in which the argument, heretofore including only the lower animals, was extended to man.

What then was this theory of natural selection, arrived at independently by two scientists, one working with wild nature, the other inspired by the same observations but experimenting subsequently with domesticated breeds?

The initial observation made by Wallace and Darwin was this: They found that species of animals or birds placed by nature in spots of relative isolation, such as islands, while preserving enough similarity to their continental relatives to make their original identity recognizable, varied in different directions thus developing new species. This discovery, certain as a fact but so far inexplicable, disposed of the then prevailing idea of the immutability of species, an idea supported by scientific authority and strongly entrenched in theological dogma.

Both Darwin and Wallace were now certain of the fact of variation. It remained to discover a mechanism by means of which it could be explained. Darwin's approach was through controlled experimentation, notably with pigeons. By interbreeding slight variants in size, form or coloration, he succeeded in producing a large variety of new forms, which, when subsequently mated with individuals of the same peculiarities, proved to breed true, that is to preserve the recently acquired traits. Here Darwin was the selecting agency. The problem remained unsolved so long as no corresponding principle was found which would operate with similar results in nature.

While continuing his experiments and pondering over the results Darwin received a hint from Malthus' famous essay "On Population" in which Malthus argues that whereas population increased in a geometrical ratio, food supply increased in an arithmetical ratio. A situation was therefore found to arise in which not enough food would be available for all the hungry mouths.

In applying this notion to the conditions found in wild nature Darwin finally hit upon the idea that wild life in nature was to be thought of as a struggle—a struggle for life, for substance—in which those in some way better adjusted to their environment—"the fittest", the "favored races"—survived, lived longer, left more progeny among whom the traits of size, shape, color, etc., which had favored the parent animals were likely to be represented to the same or even greater extent. The others—the less favored ones—having briefer lives and leaving fewer offspring, ultimately died out.

In this way it came about, for example, that arctic bears, foxes, or hares developed white coloration which was foreign to their ancestors, that the Bengal tiger who lived in tall grass wears stripes—a protective device decreasing his visibility—, that the predatory cats—the tiger, leopard, jaguar, panther, wild cat,—have sharp powerful incisors, long fine disappearing claws, and can see at night, that numerous insects are in color or in shape so much like the grass, bark, branch, they live in or on as to be practically invisible, and so on and on through the entire range of animal kingdom.

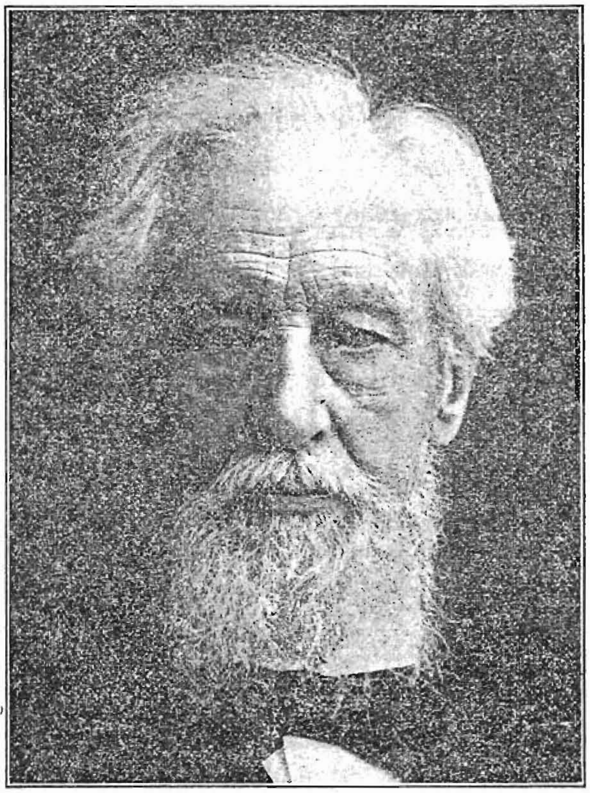
It must be noted here that the theory of natural selection took such initial variations for granted and then attempted to account for their propagation by the purely external process of selective survival. But whence the variations? And how account for their inheritance and enhancement? The problem of initial variations Darwin never solved; with the problem of heredity he dealt in his theory of Pangenesis.

Of this theory, of the reception accorded the hypothesis of natural selection and of the valiant battles fought in its name by Darwin's friend, Thomas H. Huxley, I shall write in the next issue.

Eightieth Anniversary of Hugo De Vries

By J. C. Th. Uphof

On the sixteenth of February the eightieth birthday anniversary of one of our greatest and most active biologists, Hugo De Vries, will be celebrated throughout the civilized world.



Hugo De Vries

De Vries was born February 16th 1848 in Haarlem, Netherlands. The study of botany attracted him at an early age. He studied at the University of Leiden and became greatly interested in work on plant physiology. Later he conducted researches in the laboratory of Julius Sachs in Wurzburg, Germany, which made him widely known in the botanical world. He became intensely interested in the origin of species, especially among plants.

In Darwin's day it was supposed, not as a certainty but just as a hypothesis, that new species originated gradually with but very slight changes. Dr. Hugo De Vries, then a professor of botany at the University of Amsterdam, was one of many scientists who endeavored to solve by experiment the problem of how new species originated.

In 1885 when botanizing not far from Hilversum near Amsterdam, he found in a neglected field many specimens of a well known evening primrose, *Oenothera Lamarckiana.* Among them he discovered some heretofore unknown species that had escaped the botanists.

De Vries gathered seeds of *O. Lamarckiana* and also of the new forms. They were sown in the experimental section of the botanical garden in Amsterdam. These unknown species came true from seed. But to his surprise De Vries found also that some new species occurred among the thousands of plants of *O. Lamarckiana.* Some were the same as those that he had found wild, but there were also novel ones. These species originated from the mother plant, so to speak, with a leap or mutation. Upon this De Vries built his Mutation Theory.

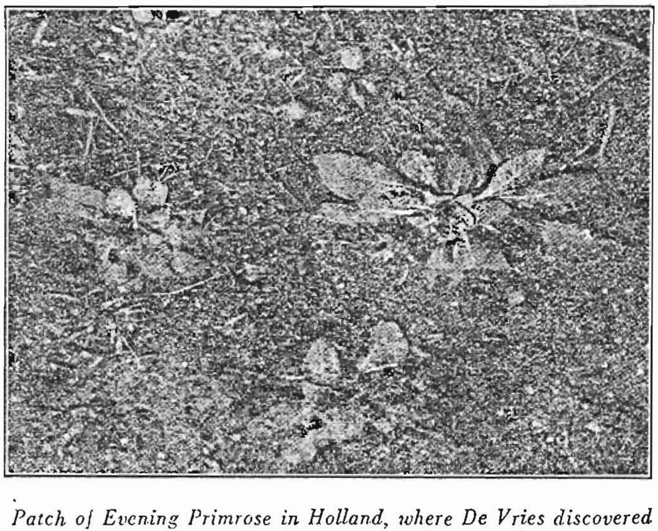
Later other investigators strengthened this Theory of Mutations by demonstrating the occurrence of such sudden variations among other plants and animals.

Hugo De Vries' name is also widely known in connection with the Law of Mendel, which has taken such a prominent place in the study of genetics and the origin of species. De Vries' book "Die Mutationstheorie" which was published at the beginning of this century attracted world-wide attention and will be important for all time.

Although Hugo De Vries retired as professor of botany from the University of Amsterdam on his seventieth birthday he still shows great interest in his work which is continuously proven by his many publications. He still conducts zealously his researches in the laboratory and experimental garden on his estate in Lunteren in Gelderland province, Netherlands.

Through his enormous energy and love for science Hugo De Vries laid the basis of genetics, namely the study of heredity and of variations, which forms the foundation of our biological sciences, of eugenics and last but not least of plant and animal breeding. Hugo De Vries, who made such brilliant discoveries and far reaching conclusions and who has thrown so much light upon experimental evolution may therefore with all respect be called the successor of Charles Darwin.

We all join his many students of the Universities of Amsterdam and of California, where he lectured for some time, and the people of the Netherlands by whom he is greatly beloved, in wishing Hugo De Vries in his own native tongue a "Nog vele gelukkige en voorspoedige jaren sij U toegewenscht."



Patch of Evening Primrose in Holland, where De Vries discovered mutation, showing mutant in foreground.

Science Bridges Gaps in Evolution of Man

By BARROW LYONS

SINCE John T. Scopes stood before a jury of his peers two years ago in the famous trial at Dayton, Tenn., science has unearthed a large amount of new evidence which reinforces the argument in favor of the Darwinian view of evolution—that man and the modern man-like apes sprang from a common ancestral stock.

Nothing has been brought to light, however, which traces the line of descent more clearly than the study of teeth made by Dr. William K. Gregory and Dr. Milo Hellman of the American Museum of Natural History.

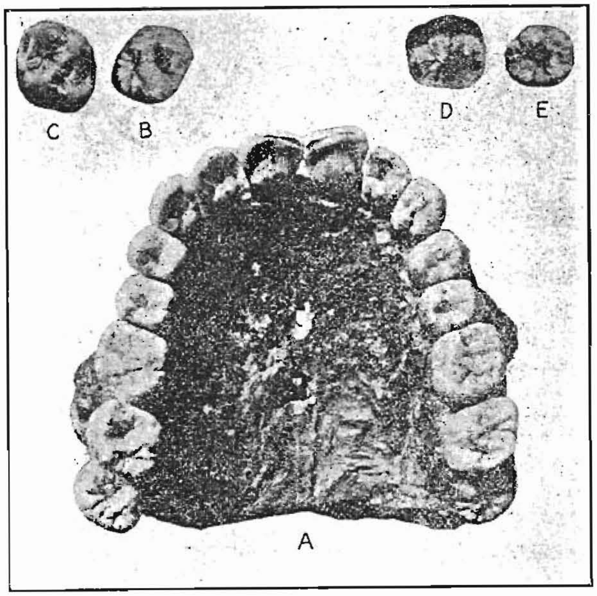
The evidence consists of fossil remains of apes and prehistoric men, teeth and bones of existing primitive types and similar records of the most highly civilized men. Teeth time and again have been the key in tracing the development of species. They are harder than other portions of the body and preserve the intricate patterns which trace the growth and adaptation of animals to their environment, often revealing habits of living which no other portions of the fossils divulge.

The patterns upon the grinding teeth in the American Museum collection of apes and men illustrate the development of the human species from its ape ancestors just as clearly as fossil remains show the development of the modern elephant with the multiple folds in its grinding teeth, from the African predecessors of the mastodon, which had but two or three ridges on its molars. They show man's marvelous change from a forest creature into a cultured, social being as clearly as another fossil group shows the development of the modern horse from a creature about the size of a fox, which ran over the open plains millions of years ago.

While the chain of evidence goes back further than the point at which the split between the apes and man apparently occurred, the immediate ancestor of each branch seems to have been a widely scattered fossil form found both in Europe and Asia. It is quite possible that none of the actual fossils that have been found were of the species from which modern forms descended. There undoubtedly were many more species at one time than we have records of, and some of these which have left no trace may have been the actual ancestors.

Yet, it may very well be that *Dryopithecus rhenanus*, found in the Miocene deposits of Germany, may have been our own particular ancestor for the resemblances to prehistoric man are, in some respects, very striking. The Miocene deposits in which they were found date back some 2,000,000 years.

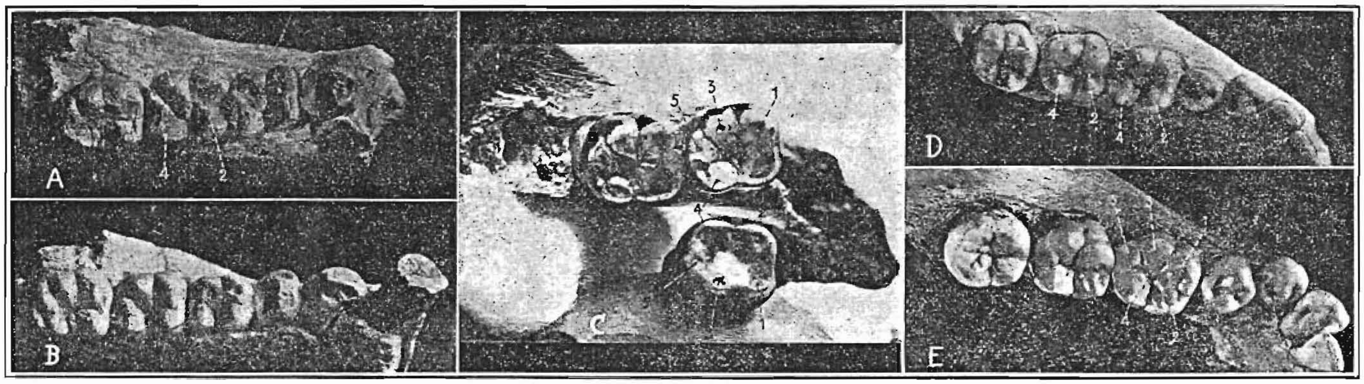
Next come the Piltdown fragments found in England in the lower Pleistocene, or early glacial period of more than 500,000 years ago. Then the Heidelberg man of the first inter-glacial period about 350,000 years ago. Then in succession the Ehringsdorf man of early Neanderthal times, 50,000 years back; the Mousterian youth of the later Neanderthal period, perhaps 30,000 years ago; Cro-magnon man of 20,000 years ago and then the Neolithic men of about 15,000 years ago.



A. Palate of fossil Neanderthal man (Le Moustier); B. Second upper molar of Le Moustier; C. Second upper molar of fossil ape Dryopithecus; D. Lower molar of Dryopithecus; E. Ehringsdorf Child.

The latter were more advanced than some of the primitive races today, like the Australian bushmen, and were the early representatives of modern, European man.

The evidence which Drs. Gregory and Hellman have presented is based largely upon an examination of first and second molars and first and second premolars, or



Lower Grinding Teeth of the Left Side.—A. B. Fossil Dryopithecus jaws from India; C. Fossil from Piltdown, England (Dawnman); D. Modern White; E. Modern India.

bicuspids. Yet, underlying the study of structure of these teeth is the fact that the whole dental formula is identical in all the forms examined, from Dryopithecus to modern man—two incisors, one canine tooth, two premolars and three molars on each side and in upper and lower jaws. Likewise, the dental formula for the milk teeth in all human races, all anthropoid apes and fossil monkeys is identical.

An amazing observation in connection with these teeth is that the crown patterns on the teeth of prehistoric men and some of the primitive living tribes are nearer the crown patterns found upon the fossil teeth of great-grand-uncle Dryopithecus than upon the teeth of civilized man. So far as teeth go, the Australian bushmen, some of the remote African tribes and certain Indian tribes are nearer the Old World apes than to you and me.

Considering the structure of teeth the gaps in the chain of evidence are closed. There are no "missing links".

How Man Differs From The Ape

By Bernhard J. Stern

I. ANATOMICALLY

IN 1860, when the Darwinian controversy was being fought out in England, Thomas Huxley was asked by Wilberforce, the Bishop of Oxford, whether "it was thru his grandfather or his grandmother that he claimed his descent from a monkey." Huxley's mordant answer is now a classic: "I have asserted and I repeat that a man has no reason to be ashamed of having an ape for his grandfather. If there was an ancestor I should feel ashamed of recalling, it would be rather a man, a man of restless and versatile intellect, who not content with success in his own sphere of activity, plunges into scientific questions with which he has no real acquaintance, only to obscure them with aimless rhetoric, and to distract the attention of his hearers from the real point at issue by eloquent digressions and skilled appeals to religious prejudice!"

Were Huxley living today when we know more about the relation between man and the apes, he would have been all the more emphatic in his assertion that man has no reason to be ashamed of having an ape for an ancestor, or rather a relative. Man in his eagerness to rationalize his own futility, and to compensate for his own shortcomings, usually exaggerates the differences between himself and his next of kin to the disadvantage of the apes. In two articles, we shall analyze these differences, devoting this article to anatomical differences and the second to psychological differences.

Much romantic nonsense has been written about the importance of the structural differences between man and apes. Drummond, for example, speaks of man alone as having the ability to appreciate divinity because his posture permits him to raise his eyes from the ground to look heavenward. We shall resist phantasy and devote our attention to actual observable differences.

Look at your hand. Move your thumb. Notice that it can be swung toward or from any other finger; it is "opposable" as anatomists say. This makes the hand effective in holding and using tools. The thumb of an anthropoid ape is much shorter than the human thumb and it cannot be moved toward and from the other digits. An ape therefore, finds it difficult, sometimes impossible, to pick up a pin between his thumb and forefinger. When he drops to the ground he walks on his knuckles and his toelike thumb is useless.

Gregory, Keith and McGregor point out, however, that this difference is functional rather than structural. There are exactly the same number of fingers, exactly the same number of bones in each finger, and the bones are positioned in the same way. Even the fingers of the hand move in the same way. Wiggle your fingers separately and in pairs and you will observe that III and IV are paired and set off against II and V. Notice how much easier it is to move III and IV together than II and III. The tendons are arranged in the same manner in the chimpanzee where the same pairing is found as in the human hand. Furthermore, the embryologist, Schultz, has shown that in the human embryo the thumb is not opposable but is like that of a gorilla or chimpanzee, a thumb that must become rotated to become human.

Man's big toe, which is a powerful lever on which the whole body can be raised and which is therefore a mechanical device for walking, is distinctively human, for the big toe of the ape is not a toe at all but rather a thumb. To convert the foot of a gorilla into that of a man, Dr. Gregory has shown that the big toe must be extended and rotated so that it rests flat on the ground instead of facing the other toes. The bones of the toes must be shortened and made to lie parallel so that the foot is narrowed, and the foot must be turned to lie down rather than in. Schultz has shown that this is exactly what happens to the foot of the human embryo in the course of its development.

The difference between the brain of the anthropoid and of man has been much discussed but recently Professor Tilney has contended that the brain of the gorilla is manlike in all fundamentals, and Dr. Smith has said "No structure found in the brain of an ape is lacking in the human brain, and on the other hand the human brain reveals no formation of any sort that is not present in the brain of the gorilla or chimpanzee. So far as we can judge, the only distinctive feature of the human brain is a quantitative one, namely a marked increase in the extent of three areas in the cerebral cortex . . . which are relatively smaller in the brain of the anthropoid apes." When it is realized that both literally and figuratively man uses only a very small fraction of his brain matter, it will be recognized that this difference is not as important as is commonly assumed.

Next month: How Man Differs from the Ape: Psychologically.

What Can Children Inherit?

By HENSHAW WARD

THE student of heredity will tell you that no abuse of body or mind can be inherited, and that no good training of body or mind can be inherited. He would go so far as to say that the following imaginary case illustrates the truth: "Take a pair of infants (a boy and a girl) to a wilderness and bring them up without any education of body or mind; take another pair of infants who have inherited the same qualities as the first pair and give them every advantage of good breeding; let each pair mate and produce a son; the son born in the wilderness will have as much ability as the son born in fortunate surroundings.

I am not saying that this imaginary case represents the whole truth, nor that all biologists are agreed as to what the truth is. I am just giving an example to show picturesquely the two elements of life that biologists dispute about—(1) the germ-cell by which qualities are transmitted to children; (2) the bodily and mental changes produced in a person after he is born. All the influences that act upon a person (such as climate, food, training, accidents) are called the "environment." The effects of the environment upon an idividual, (for example, loss of a finger, skill in using a revolver, a morphine habit) are called "acquired characters." The great debate in biology for the past seventy years has been on the question: Can acquired characters be inherited? During these seventy years the opinion of scholars has steadily grown stronger that acquired characters cannot be inherited.

This judgment of science seems harsh to conscientious parents. It seems wicked to some hopeful social reformers, because it seems to say, "No matter how much you improve the surroundings and education of this generation, none of the improvement can be inherited by the next generation." It seems to say that heredity is everything and environment nothing, so that men are born to a certain condition in life. It seems to favor a caste system where those unfortunately born cannot rise. Hence it is disliked. People are always eager for proof that acquired characters *can* be inherited.

There are still a few of these bringers of glad tidings in the laboratories. Though the vote of biologists is a very heavy majority against them, the decision is not unanimous. And recently some of the leading students of heredity have been telling us that we don't know what "environment" means or how environment may effect germ-cells or how characters are formed in germ-cells. Only the other day a biologist declared to me, "Within the last three years I have entirely revised my notion of what the genes are." Hence the layman who wants to read about heredity may find two noted scientists seeming to dispute one another, and so may give up in confusion.

I will try to show that the confusion is mostly a matter of words. Biologists are not really at loggerheads about the main points at issue, nor do their revised notions of the genes give them very different conceptions of what children can inherit. They are pretty well agreed on a theory of inheritance, and a layman can understand what it is.

If you wish knowledge, you must, in the first place, put out of your mind all anger. A man who wants to uplift society or improve his children cannot succeed by ramming his emotions against the hard facts of biology.

You must, in the second place, read a description of the way every individual begins his life by the union of two cells. (The best brief account that I know of is Chapter XVI of L. L. Woodruff's "Foundations of Biology.") In this short article there is only room to name the facts, without giving any explanation.

The egg (a cell 1/200 of an inch in diameter) contains within itself, potentially, all the elements for the making of an entire human being. The sperm (a cell only 1/8000 of an inch in diameter) also contains all the elements of an entire person. But neither cell can develop alone. A new human life does not begin until the sperm has penetrated the egg. Then the elements from the mother and the father are mingled in one cell; this divides into two cells; each of these two cells divides into two others; and so, as the embryo develops, the cells increase in number until there are millions of them. All the while the embryo lives as a kind of parasite within the mother, having its own system of blood-circulation. The number of cells increases to billions. There are trillions of them at birth.

Thus every one of us began life as a very small and infinitely complex organism, which contained the characters inherited from the father and mother. If the environment can ever affect heredity, it must manage somehow to penetrate a parent's body and alter the germ-cell in some definite *corresponding* way. The more familiar science becomes with the powers of germ-cells, the more difficult it is to imagine a way in which an environment could get at them.

No biologist believes nowadays that any effect of the environment on a woman's body or mind can enter into an embryo and produce a *corresponding* alteration that can enter into the inheritance of her children. For example, if she is frightened by a bear or a bright light, her child will not have claws or a white spot on its body. If a hundred successive generations of Chinese mothers bind their feet, or a hundred generations of Jewish boys are circumcised, no effect of these long-continued bodily changes is ever inherited.

During the past thirty years the biologists have been steadily abandoning the supposed cases of the inheritances of acquired characters. It is not likely that any student of germ-cells now believes that skill in penmanship can penetrate an egg and be born in a child. No amount of training for the mile run can cause a sperm to build larger muscles in an embryo. No amount of education in religion or logarithms or atheism or burglary can enter into a germ-cell and build more mathematical or burglarious brains. The possible cases of inherited effects of training are very few and not well accredited.

Now that we have seen the field where practically all scholars are unanimous in their opinion, we are prepared to look at the edge of the field, at the boundary where the battles of conflicting opinion rage. I can illustrate what all the battles are about by citing three extreme statements of eminent professors. In each one you will see that the man has encountered a flood of ignorance and foolishness, that he has done good by scornfully exposing folly, but that, for the sake of making his point, he has gone further than the whole truth warrants.

1. There is much folly talked by educated people about the inheritance of ways of behaving. They assume that gentlemanly conduct or vicious habits of life are inherited. But John B. Watson of Columbia finds no shred of evidence that any such inheritance of conduct is possible. Conduct, he finds, is a matter of the training that an individual receives. Therefore Watson makes the extreme statement:

> We have no real evidence of the inheritance of mental traits . . . I would feel perfectly confident in the ultimately favorable outcome of careful upbringing of a *healthy well-formed* baby born of a long line of crooks, murderers and thieves, and prostitutes. . . . Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in, and I'll guarantee to take any one at random and train him to become any type of specialist I might select—into a doctor, lawyer, artist, merchant, chief.

Watson's extraordinary claim can never be proved or disproved, because he cannot have his own specified world in which to experiment. He has doubtless stated a fifty per cent truth, for it seems likely that criminals and business men are largely shaped by their environment, and not by inheritance of mental traits. But most psychologists and biologists are compelled to believe that many persons are born with such mental equipment that they could never be great musicians or artists.

2. The most important idea in twentieth-century study of heredity has been "Mendelism," the theory of the way in which bodily characters are formed in germ-cells by certain definite

parts of the cell mechanism, sometimes visible under the microscope, called "genes." In the early days of research men talked with easy assurance of how every character was formed by a certain gene or part of a gene. But lately it has been found that the process of embryo-building is by no means so simple: we now know that even a slight character may be shaped by the interaction of dozens of genes, perhaps of hundreds. Much of the theorizing about inheritance is now seen to be erroneous. So H. S. Jennings of Johns Hopkins was moved to write a little book, "Prometheus," in which he spoke strongly of the misconceptions. He is one of the most careful men in his profession.

> The characteristics of the adult are no more present in the germ-cells than are those of an automobile in the metallic ores out of which it is ultimately manufactured. . . . The characteristics that appear under training are as much inherited characters as are those appearing under other conditions.

If a college debater quoted those sentences out of context, his audience would suppose that Jennings is disputing the whole world of biologists. But actually he is doing nothing of the sort. He is engaged in an abstruse argument about the way biologists use certain terms, and he has gone so far in stressing a point for experts that he misleads a non-technical reader. He himself foresaw that he would be misunderstood and tried to avoid the danger by saying in a footnote:

> Nothing in the text relates to the effect of education on the descendants of the educated person.

And that effect is all that concerns us in this article. The quotations from Jennings are typical of how a line of sound reasoning may be perverted, and so deceive us, when a bit of it is cited in another line of reasoning.

3. A very influential writer on heredity is Raymond Pearl, also of Johns Hopkins. He contributed to the *Mercury* for November, 1927, a slashing article about the fallacies that are making eugenics absurd. It was a wholesome article that will do a lot of good. At one point he remarked fiercely:

> Heredity does *not* mean that like produces like.

If any competent biologist reads the whole article and gets Pearl's drift, he might not object to the extreme statement. But if it were used, out of context, by a debater, it would appear to say that the children of lunatics are just as likely to have good minds as the children of sensible and intellectual people.

Be wary when you hear any such extravagant statement which seems to bowl over the foundation facts of heredity. One admirer of both Pearl and Jennings has said of their popular essays, "These are insidious because they mislead the general reader." The foundation facts of heredity are not altered every time a cytologist tries to true up the tricky uses of technical terms. The facts still stand as the basis of biology after all the assaults of the last thirty years. They were admirably summed up by G. Kingsley Noble, a curator of the American Museum, the man who exposed the fraud in Kammerer's experiments. He wrote for *Natural History*:

> Heredity gives an animal more potential characters than can ever develop. Environment determines which of these shall appear, but it cannot produce characters which are not provided for by heredity. The actual inheritance of an animal is thus ultimately dependent on the original complement of genes. . . . All inheritable adaptations have arisen independent of the environment.

There is not yet any proof that the human animal can produce characters which are not provided for by heredity. He cannot, by any sort of education, create new genes in his sperms or eggs. A child cannot inherit any training—good or bad—of a parent's body or mind. It can inherit only what is provided in germ-cells.

Does the judgment of science seem pessimistic to you? It is just the contrary. As for environment, its importance is not diminished; an improved environment can be a blessing to each succeeding generation without being put into germ-cells. And as for not inheriting good training, think of the other side of the matter. Think of how children are safeguarded by not being able to inherit the bad training. If we sentimental human beings could change the process of inheritance, and if we made the follies of parents inheritable, the human race would soon die.

Life, Love and Civilization

By GEORGE A. DORSEY

SEX came into life about fifty million years ago. It brought Love and led to the peacock and civilization.

Life is older than sex. The love to live is the older passion—so strong that man invented religions to rob death of its sting and the grave of its victory. But man's love for woman is a passion second only, if at all, to that of man's love for life.

This must be so. Sex is nature's device to make life richer, more economical, more enduring, and less the sport of chance. Having built sex into bodies and having charged sex with carrying on, nature has to see to it that sex does its work. From nature's point of view, mating is as important as living—not to mate is death to the stream of life. As long as the stream renews itself, life flows on; without renewal, the stream runs dry.

Or, look at it this way. Lowest organisms carry on by mere division—one body becomes two, two become four. One bacterium in a few hours produces billions, each potentially immortal. But mere division limits diversity—the "offspring" are all alike; there is little chance for heredity to work improvements, and the whole body has to stop its work to become two. Sex is the device to get around these limitations. It worked wonders—it opened up new worlds of life; but it had to work, for the burden of handing life on was taken from division and put on multiplication. Sex had become the bearer of immortal life on earth.

Whereas nature once said: Eat and divide; she now said: Eat, drink, and be married!

Rape is no more a crime in nature's eyes than stealing a loaf of bread; both spring from primordial hunger. Fortunately, rape is rarely necessary. Civilization cannot choke the life out of nature—nor breed a race of celibates or of vestal virgins.

Nature did not stint the endowment of either sex. The lion may have more mane and a louder roar, but when it comes to a journey for a mate the lioness is the faster traveler. The female rat will brave a danger to find a mate that only starvation pangs could make her face—and she will face it sooner than the male.

Lions and rats are uncivilized. So are we all at birth. We cannot walk, we cannot talk—and left to ourselves would perish. Our hands can support our body, but our legs can not; our backbone is as yet fit only for a wriggle. Our body grows human; we learn to act like humans. Meanwhile, who nourishes us? Who bore us?

The male bird wears the fine feathers. In civilization he provides them—and wears them vicariously. This requires energy and strategy.

Civilization is, of course, more than all this. It is the accumulated deeds done to make life secure and the prayers uttered to make life everlasting. It is also the heaped-up spoils man has laid at the feet of woman and hung on the walls of his home.

Though life is older than love, they pooled their forces eons ago and have been partners ever since. They are as potent today as ever—they make up man's inheritance, they furnish the drive to civilization.

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DARWIN WAS RIGHT

On this anniversary of Charles Darwin's birthday let us bring to the attention of our neighbors the verdict rendered on Darwin's work by the recent Congress of the British Association for the Advancement of Science through its President, Sir Arthur Keith.

After summing up in masterful fashion the unanimous evidence from a dozen fields of science, based on half a century of painstaking investigation, he concludes:

"Was Darwin right when he said that man, under the action of biological forces which can be observed and measured, has been raised from a place among anthropoid apes to that which he now occupies? The answer is YES. And in returning this verdict I speak but as foreman of the jury—a jury which has been empaneled from men who have devoted a lifetime to weighing the evidence."

The efforts of fundamentalist fanatics will prove futile. As the human race develops and progresses Charles Darwin will be honored more and more as *the great emancipator of the human intellect.*

NASHVILLE

Our hope that from the convention of the American Association for the Advancement of Science, held recently at Nashville, Tennessee, there would come a courageous call to action to rally the friends of academic freedom against the fundamentalist reaction was not realized. The leaders of the organization seem to feel that by shutting their eyes to the danger it will disappear.

However, at this Nashville convention a number of very notable contributions were made to the evolution literature. These will be reviewed in our next issue.

THERE ARE OTHERS WHO CAN'T TELL

By JOHN M. WORK

I NOTICE that Edwin Tenney Brewster wants S. Parkes Cadman to tell when the soul entered into man.

I should like to ask Mr. Brewster how evolution got started; also when and how life entered into matter.

There are multitudes of things which nobody knows. I believe in evolution, and I can ask Mr. Brewster as many unanswerable questions as he can ask Mr. Cadman.

The present existence of the soul is as evident as the existence of the body. Whether or not the soul is immortal is a disputed question, but there is nothing in evolution which precludes its immortality, and many great thinkers—scientists and otherwise—believe it to be immortal.

In short, this is just another way of saying that I do not see any good reason why different believers in evolution should attack one another's views upon extraneous questions in your periodical; but if you are going to let evolutionists of one type of religious or anti-religious views attack and ridicule the others, then I take it that you will let the others make reply in your columns too.

ONCE MORE WE SAY IT

In view of the mountainous mass of manuscripts received it is necessary to re-state our policy:

"EVOLUTION will be non-political, so that all upholders of academic freedom can support and use it no matter how they differ on other sissues. It will be non-religious, never making any effort to reconcile science with religion. Nor will it make atheism its mission. It will carry the positive message of facts from every field of natural science and leave it to the reader to make his own mental re-adjustment."

Articles "proving evolution by the bible" or claiming that the bible is bunk, or that "properly interpreted" the story of Genesis and modern science agree, or that every scientist must be an atheist, are alike foreign to the purpose of EVOLUTION.

EVOLUTION is to tell in popular language what scientists have discovered about the processes of nature.

We welcome articles: 1. Containing specific proofs of evolution. 2. Championing the right of the schools to teach whatever science has discovered. 3. Scientific news items. 4. News regarding the struggle with the fundamentalists.

EVOLUTION DINNER

The First Annual EVOLUTION Dinner has now been set for Monday evening, March 19th. This will give an opportunity for the writers, supporters and readers of EVOLUTION to get acquainted. Details in our next issue.

INFINITY AT BAY

By ERNEST UNTERMANN

SCIENTISTS make great efforts to refute fundamentalist illusions by evidences of evolution in skeletons, tissues, organs, limbs, teeth, skulls, vestiges of primitivism in embryos, and the like.

Such proofs impress only people who can use their brains freely. A regular fundamentalist suffers from brain paralysis due to the malignant growth of a complex which believes in god, free will and immortality.

This complex is not cured by mere scientific argument or evidence. Hallucinations of belief defy science and decline proof. A believer always says: Just because my faith cannot prove its divinity, it must be believed.

This is a case for the doctor, not for the lecturer. Kant said long ago: Even if god, free will and immortality cannot be proved by science, they should be believed for moral reasons.

This may not impress a savage who makes his own idols by hand and smashes them when they don't deliver the goods. But it works every time with the believer in an immaterial, supernatural, invisible, personal or diffused god.

The scientist may ask: Why should I have to prove anything to a fellow who refuses to analyze his own belief by reason, and why should not a fundamentalist be required to justify his belief by reasoned proofs instead of mere assertion? But the fundamentalist will reply: Belief is inspired, not acquired.

The scientist may counter: You can't believe without your brain. Will that shock the fundamentalist into reason? Not a bit. He will retort: My soul is not in any way attached to my brain. No matter what my brain thinks, my soul knows god in ways independent of natural law.

Now the scientist proves that any change in normal brain tissue and function by accident or disease makes all reasoning abnormal, and that all personality or soul is wiped out when the brain is wrecked. Does the fundamentalist feel that this hits him in the bull's eye?

Why should it? Prove to him that his brain with every idea in it, including his god complex, is a natural product of evolution, and he will still cut your science into shreds with a knife that has neither blade nor handle. He believes that his soul can think of god, free will and immortality even after his whole body is dust, the earth wiped out, the sun, moon and stars reduced to broken atoms, and the universe a black void. He is face to face with his god even then, a hundred per cent. fundamentalist of twentieth century coinage in a state of pure inspiration, nothing up against nothing, the infinite at bay against It.

What Caused Noah's Flood?

By DR. J. LEON WILLIAMS

In a discussion on evolution which took place in New York between the Rev. Dr. Straton, Fundamentalist leader, and Rev. Mr. Potter, the latter was evidently surprised and somewhat discomfited by a very adroit manoeuvre on the part of Dr. Straton during his speech.

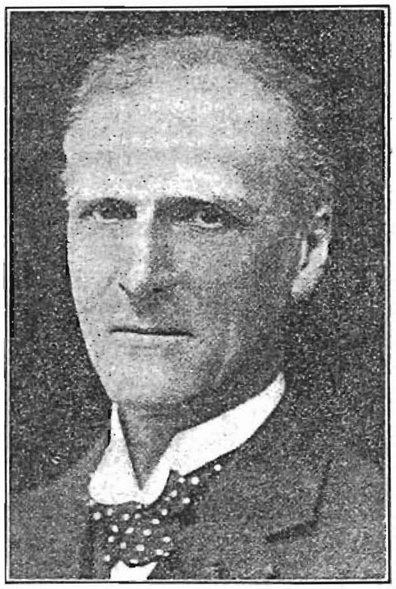
He said that an eminent scientist, a "professor in one of the great institutions of learning in Nebraska," had written a book called "The New Geology" which sent all previous works on the subject and the theory of evolution into the lumber-room of discarded things. Mr. Potter was unable to make any reply to this and, in the opinion of the judges, he lost the debate. The morning after the discussion I visited several of the largest bookstores in New York in the effort to procure this wonderful new work on geology. But no one consulted had even heard of it. But it really was in existence, and I eventually secured the intellectual treasure. The *eminent scientist* from the *great institution of learning* turned out to be a teacher in a small sectarian college. I found that the author had taken his stand squarely on the Bible story of the Flood (or, at least, this was what he pretended) and the cause of the Food as the explanation of the more important geological changes on the surface of the earth. But, appreciating the difficulties of the Bible account of the causes of the Deluge, the author of "The New Geology" has apparently invented a theory of his own. He surmises that a huge meteorite or asteroid, or something of like character, came from somewhere in space and struck the earth and gave it such a shock that it set it badly wobbling and changed the inclination of its axis.

But we will let Mr. Price tell his story in his own words. He says that "the hypothesis of a world catastrophe deals with the world as a whole, that is, it deals with the world in its planetary aspects; and therefore this catastrophe must have been of an astronomical character. . . But the only astronomical cause which we can readily imagine as competent to bring about such results would be something of the nature of *a jar or shock from the outside*, which would produce an abnormal tidal action, resulting in great tidal waves sweeping twice daily around the earth from east to west, this wave traveling 1,000 miles an hour at the equator." And then, after mentioning the "inconceivable amount of geological work" which this shock would produce, Mr. Price adds this: "In the meantime, the surface of the earth would be shattered and dislocated beyond all description; and twice each day, the oceans would sweep a mighty tidal wave around the world, attaining a maximum, every 150 days, of about six miles in height at the equator." Accompanying the event were "storms such as the world has never since witnessed."

There is not a single item in this theory of the cause of the Deluge which corresponds to the account given in the Bible, and yet these Fundamentalist sticklers for a rigid adherence to the literal words of the Bible, as all divinely inspired, welcome, with every evidence of great joy, this new and purely imaginary theory of the cause of the Flood. The followers of Mr. Bryan are never weary of heaping scorn on what they call the "theories", "hypotheses" and "guesses" of evolution, but they will swallow whole, without a wince, an insane absurdity like this, for which there is not the slightest trace of evidence and in face of the fact that it contradicts the Bible story in every particular.

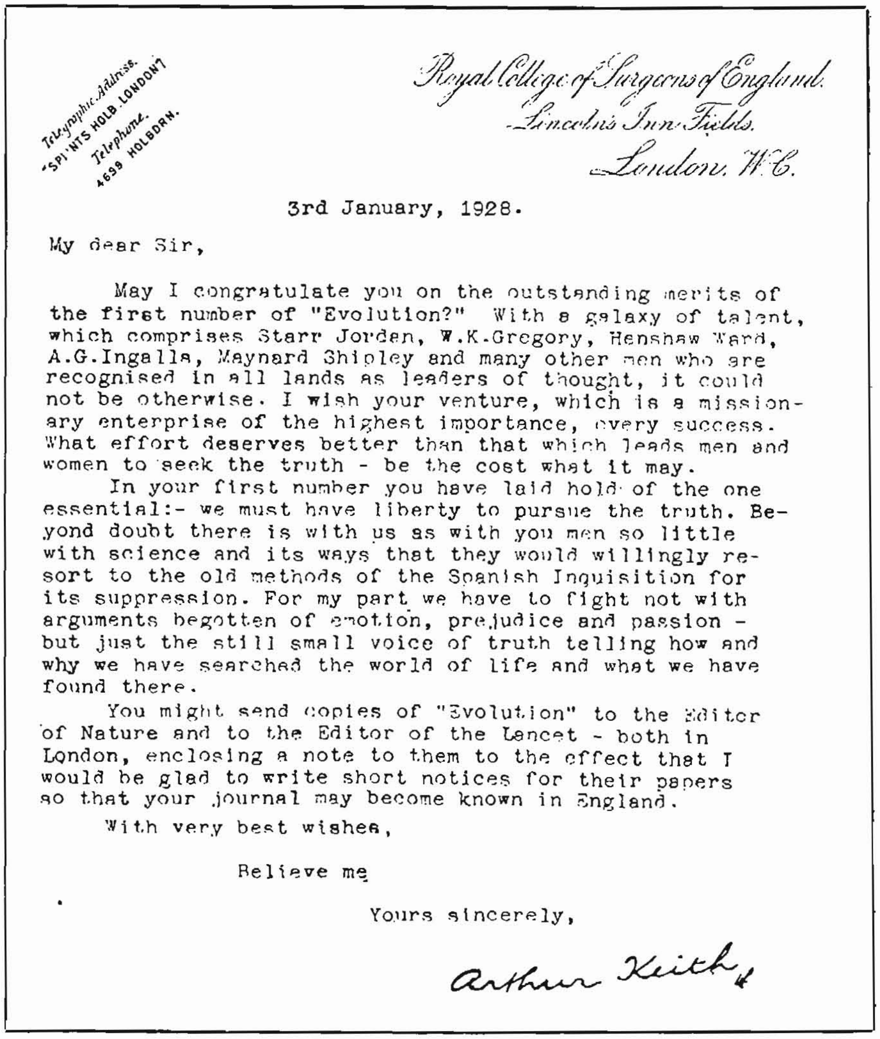
Of course, no geologist of reputation will waste his time in any detailed attention to this travesty of science called "The New Geology." But I may permit myself one comment. When we contemplate the spectacle of Noah guiding that box without sail or rudder, through the most awful storms the world has ever known, climbing those mountainous waves six miles high and running 1,000 miles an hour, I am lost in admiration for the most consummate seamanship that has ever been exhibited in the history of navigation. Truly, there were sailors in those days!

CONGRATULATIONS



SIR ARTHUR KEITH

whose ringing declaration for Darwinism as President of the British Association for the Advancement of Science at the recent congress in Leeds was heard around the world, sends us the following:-



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Royal College of Surgeons of England.
Lincoln's Inn Fields.
London. W.C.

3rd January, 1928.

My dear Sir,

May I congratulate you on the outstanding merits of the first number of "Evolution?" With a galaxy of talent, which comprises Starr Jorden, W.K.Gregory, Henshaw Ward, A.G.Ingalls, Maynard Shipley and many other men who are recognised in all lands as leaders of thought, it could not be otherwise. I wish your venture, which is a missionary enterprise of the highest importance, every success. What effort deserves better than that which leads men and women to seek the truth - be the cost what it may.

In your first number you have laid hold of the one essential:- we must have liberty to pursue the truth. Beyond doubt there is with us as with you men so little with science and its ways that they would willingly resort to the old methods of the Spanish Inquisition for its suppression. For my part we have to fight not with arguments begotten of emotion, prejudice and passion - but just the still small voice of truth telling how and why we have searched the world of life and what we have found there.

You might send copies of "Evolution" to the Editor of Nature and to the Editor of the Lancet - both in London, enclosing a note to them to the effect that I would be glad to write short notices for their papers so that your journal may become known in England.

With very best wishes,

Believe me

Yours sincerely,

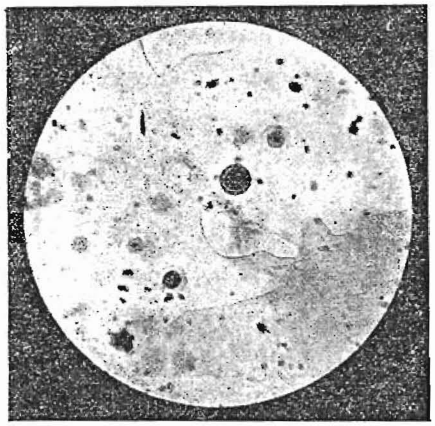
Arthur Keith

How Old Is the World?

THE EVIDENCE FROM RADIO-ACTIVITY

By ALLAN STRONG BROMS

IN the last few years a very reliable test of the age of the earth has been found in the breakdown of the radioactive elements uranium and thorium into ordinary lead. We can measure the rates of breakdown in our laboratories by counting the number of helium atoms released in the process. The rates prove to be so very slow that one-half of a particle of thorium needs five billion years to "transmute" into lead, while one-half of a particle of uranium takes even longer, about thirteen billion years. To transmute one-half of the remaining particle takes another five or thirteen billion years, and so on indefinitely. These rates are unchanging, for heat, cold, pressure, electricity, anything we can do, seem to have no effect.



The elements uranium and thorium are found in small quantities in rocks of various geologic ages and if we can only determine how long they have been breaking down since they were included in those rocks, we will know just how old the rocks are. This very thing has been done by a number of scientists, among whom Professors Soddy and Joly are conspicuous. It has been done in three quite independent ways, with results fairly in agreement.

Uranium is the heaviest of the elements, its atom weighing about 238 times as much as that of hydrogen, its atomic weight being therefore 238. It breaks down by a series of steps, at certain of which it gives off helium atoms (atomic weight 4) and thus loses weight until it winds up as a kind of lead having an atomic weight of 206. Thorium, which starts with an atomic weight of 232, also breaks down by steps, loses helium atoms and weight and ends as another kind of lead of atomic weight 208. Our ordinary lead, which weighs about 207, is a mixture of these two pure kinds.

THE URANIUM-LEAD RATIO

If a mineral is found to contain uranium (but no thorium) and lead of atomic weight 206, we need only measure their relative amounts, apply a simple mathematical formula and learn how long the uranium must have been breaking down to produce that certain proportion of lead. The longer the time, the more lead there will be and the less uranium. Many investigators, analysing rocks from widely separated parts of the earth's surface, have independently reached results remarkably close, the ages for the oldest known rocks ranging from one to one and a half billion years. The overlying, hence younger, rocks always show a lower proportion of lead, a very convincing test of the method.

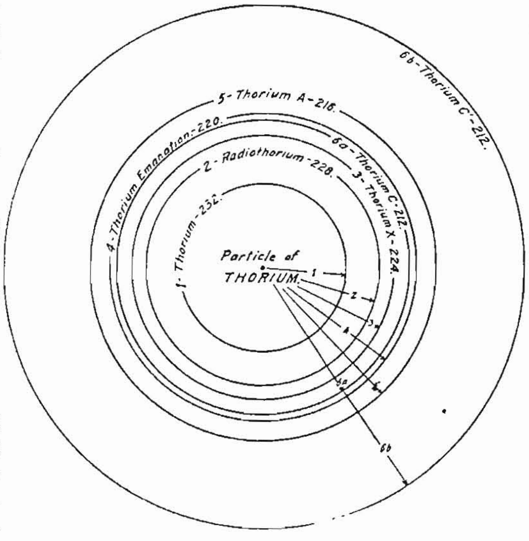
Of course, the thorium-lead ratio can be used instead. The ages indicated are generally less, but the fundamentalist will find no consolation in this, for they still run into the hundreds of millions.

THE URANIUM-HELIUM RATIO

In breaking down to lead, the uranium atom gives off eight helium atoms and the thorium atom gives off six. If we measure the relative amounts of uranium (or thorium) and helium, we ought again to be able to fix roughly the ages of the rocks. But as helium is a gas and likely to be lost from any but the most solid rocks, the results should be somewhat smaller and so we find they are.

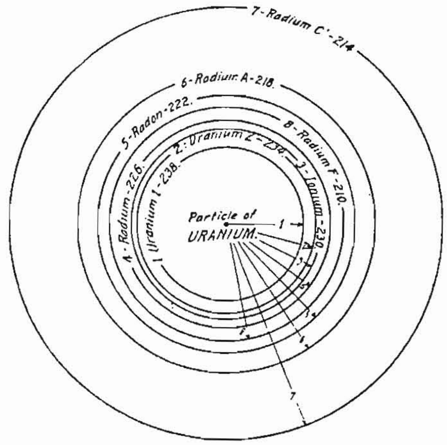
DISCOLORATION HALOES

Professor Joly has made much use of a third method depending on the fact that a particle of uranium or thorium embedded in certain colored micas will slowly discolor the nearby mineral matter, producing minute spherical shells of discoloration. When viewed in cross-section, these appear as concentric rings or haloes. They are produced by the helium atoms shot out at the several steps of radioactive breakdown. As they are shot out at differing (yet definite) speeds at each of the several steps, they travel to different distances and thus produce clearly defined rings.



In the diagrams, these various penetration distances are shown for the helium atoms from both uranium and thorium. Each step in the breakdown is given its consecutive number, each disintegration product is named and its atomic weight given. Obviously, the high speed helium atoms from Radium C' and Thorium C', as they get no help from their brother atoms, can discolor the outer rim of the haloes but faintly. In the microphotograph of the thorium haloes, this outer shell is clear.

Note also in the diagrams that the helium atoms from thorium penetrate further and produce larger haloes. The largest uranium halo is only one four-hundredth of an inch in diameter, while that from thorium is one three-hundredth. The sizes therefore identify the parent radioactive substances, and the degrees of discoloration measure the ages of the surrounding mineral. Some of the oldest show very clearly the effects of "over-exposure," just like a photographic plate. Joly found that the younger a rock was geologically, the less discoloration there was. His estimates of rock ages based on this method involve hundreds of millions of years.



The three methods of fixing geologic ages from radio-activity agree too closely in their results to leave any serious doubts as to the enormous age of the earth crust. And before the earth crust—who knows how many billions of years must have passed? Certainly the fundamentalists' six thousand years are as impossible as the rest of their absurd notions.

NEXT: Some more on radioactivity and its part in the evolution of the earth.

FUNNYMENTALS

"In its conception, development and application evolution is utterly false, as false to science as to Scripture; and so Scripture and this unproven and unprovable hypothesis can never speak together. Truth is the embodiment of intolerance. It cannot be forced into any fellowship with falsehood. God's word is Truth. Darwin's theory is falsehood. Between them there can be no fellowship. . . .

"If it were in my power I would take every false teacher out of every pulpit and professorship in the land. . . .

"If any philosophy was ever weighed in the balance and found wanting to such an extent that intelligent men ought to turn with loathing from the same, it is the theory of evolution; and if there is a spot on earth where this theory has rendered any profit to an individual, to society or to the State, let its advocates migrate to that spot and continue their teachings there."—Rev. W. B. Riley, in February, 1928, Christian Fundamentalist.

"Evolution is an unchristian fraud. It is a blank unproved theory unsupported in fact. It is illegal to teach it in tax-supported schools. Under the common law it is blasphemy."—Evangelist L. S. Hoover, Ithaca, Journal News, Jan. 3, 1928.

"I want the people of Mississippi to know that, as Assistant State Superintendent of Education, I believe that man was made in the image of God, his Creator, and I favor putting out of the schoolroom any man or woman teaching any other doctrine."—Knox M. Broom, A. B., quoted by American Mercury, Jan., 1927.

"I would rather my babies' eyes be gouged out at this minute than to have them taught this blatant atheism. When you teach a man that he is nothing more than an evolved animal he is going to live like a beast. When you teach a community or a nation that they are made up of animals, they are going to live like a jungle. Monkey men mean monkey morals. If evolution is not checked, it will put America into a seething pit of anarchy within ten years."—Gerald B. Winrod, "The Mark of The Beast"

"As nearly as we know it at present, the Lord's return took place between 45 and 50 years ago; and all the upset times the world has had since are simply signs that Christ is getting ready to destroy all the bad and wicked works of the devil, who has kept mankind in trouble for so many thousand years."—Int. Bible Students Association, October 5, 1927.

"The discoveries of modern science make it impossible to place any credence whatever in Darwinism. Darwinism has been almost wholly discarded by scientific men." —George McCready Price, in January, 1928, Signs of the Times.

"People give ear to an upstart astrologer who strove to show that the earth revolves, not the heavens or the firmament, the sun and the moon. But sacred scripture tells us that Joshua commanded the sun to stand still, and not the earth."—Martin Luther.

"We make bold to assert that from the beginning to the end of Genesis there is not a blunder from a scientific standpoint." —Dr. Harry Rimmer, President of the Fundamentalist Research Science Bureau.

DEBATING EVOLUTION IN NORTH CAROLINA

By Howell S. England

In the spring of 1926 Dr. T. T. Martin, National Secretary of the Anti-Evolution League of America arranged two debates with the writer in Charlotte, North Carolina, on the subject of Evolution.

The debates were very unpopular. No hall could be had in the city. When an amusement park several miles out of town was secured the local Ku Klux Klan let it be known that no atheist should ever be allowed to set foot in the state of North Carolina, much less to speak there, and that upon my arrival I would be captured, taken in charge by the hooded gentlemen, and promptly put on the next train out, possibly having received in the meantime an appropriate coat of tar and feathers.

After the American Civil Liberties Union had informed the Governor of North Carolina and the mayor of Charlotte that the constitutional right of free speech should not be abridged in their city and state, the local Klan executed a beautiful somersault and announced publicly that they would see I was protected in all my constitutional rights, and that they had five hundred men in the mountains who would come down if necessary for my protection.

So the debates took place; and if the applause that followed our points was an indication, I had as many backers in the audience as had Doctor Martin. The moderator of the first debate was a former judge of the circuit court. He was eminently fair. The moderator the second night was a fundamentalist preacher by the name of Holland who became very solicitous as to the time taken up by myself as soon as I began to make light of the account of creation and the flood in Genesis.

Holland said to me after the debate, with what was intended to be crushing severity: "Mr. England, you are the first man I have ever heard willing to admit that he did not believe the divinely inspired story of creation as given in the Bible, and it will give me great pleasure in recalling this incident to remember that the same man acknowledged he was a blood-brother to the skunk and the turkey-buzzard."

Apparently many people in the audience heard the story of evolution for the first time at these debates. One woman asked in all seriousness: "Mr. England, do you really believe that what you told us this evening is the truth?"

The people of North Carolina I found hospitable, eager to hear and to learn what the debates were about. The crying need of the state, as I see it, as well as of all the other states in the Bible belt, is modern education broadcast among all their people.

Really Bright Son—"Say, Dad! Teacher says we are descended from monkeys."

Fundamentalist Father (not so bright)—"Nonsense! You may be, but I'm not!"

SHARES AVAILABLE

The Evolution Publishing Corporation, organized under New York State laws, offers its $10.00 shares of 6% preferred stock. With every five shares of preferred one $10.00 share of common, voting stock will be given, if paid before March 20.

The immediate business is publishing this journal, Evolution and selling books. Later a Lyceum Bureau for touring natural science lecturers will be developed.

Although it is expected the business will pay, share-holders are not invited on the basis of making profits, but because this work is WORTH DOING.

Additional capital furnished now will help make the circulation campaign for Evolution magazine a success. Checks should be made payable to Evolution Publishing Corporation. In remitting kindly state whether payment is made in full, or whether it should be applied on a larger block of stock to be held until balance is paid.

LET US MAIL SAMPLES TO YOUR FRIENDS

Of course you'll show this issue of Evolution to your friends and ask them to subscribe. But you probably know some who would be interested, whom you can not visit yourself. Send us their names and addresses and we'll mail them sample copies.

It will cost us about five cents a copy to send out these samples, so if you can send along a check to help pay for them we'll not object. However, if your bank account is minus don't let that stop you. Send us the names anyway and we'll raise the cash otherwise.

WHAT'S A HUNTER WITHOUT AMMUNITION?

A hunter without ammunition is in the same fix as an evolutionist without copies of Evolution. Surely YOU don't want to remain in such a pickle. The best way out is for you to fill in appropriate characters on the following blank in a hurry.

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The Origin of Reptiles and Birds

By MAYNARD SHIPLEY

TOWARD the close of the Age of Amphibians extensive land elevations occurred throughout the world, draining swamps and drying up ponds and lakes. Nearly all the continents were then connected by land bridges, and cooler temperatures prevailed. There was every incentive for an extensive development of land animals. The transition from low lands to high lands being gradual, many of the Amphibia were sufficiently plastic to meet the new conditions, by slow, progressive adaptations, modifications of pre-existing structures.

It is quite possible that some fish-like form gave rise to both Amphibia and Reptilia. Be this as it may, we know that, as stated by Prof. H. F. Osborn, "the most ancient solid-headed reptilian skull type is very similar to that of the solid-headed Amphibia. Bone by bone its parts indicate a common descent from the skull type of the fringe-finned fishes."

Prof. Charles Schuchert remarks: "It is becoming increasingly difficult to distinguish the late Paleozoic reptiles from their stegocephalian associates." But the "mailed headed" or armored Amphibia are not regarded as the most primitive of land vertebrates. Evidence is rapidly accumulating, Professor Schuchert tells us, to show that the stegocephalians "arose in an older stock (*Protopoda*), which gave rise on the one hand to the water-loving amphibians, and on the other to the reptiles, which became completely adapted to the dry land."

We know that the Amphibia and Reptilia have as common ancestor a lung-breathing and gill-breathing fish, and that the Reptilia gave rise on the one hand to the lowest or egg-laying mammals and on the other to birds.

The lizard-like reptiles gave rise to two distinct types of dinosaurs, one of which, bird-like ischium, shows many structures similar to those of birds—e. g., brain, reproductive organs, pelvic bones, three toes, ankle bones united with the leg bones, etc. Feathers are but modifications of reptilian scales, with the edges frayed out. Like the scales of lizards, feathers are a development of the outer or horny layer of skin. Not only is the skeletal structure of birds essentially reptilian, but they are also much alike in their developmental history, from fertilization of the reptile-like egg to their emergence from the envelope or shell. Jurassic and Cretaceous birds possessed reptile-like teeth, and some of them had not yet lost their reptilian claws.

Fortunately, two fossil specimens of the Jurassic bird—the most primitive known—were found in a slate quarry at Solenhofen, Bavaria. It was about the size of a pigeon. So closely related to the reptiles was this genus of bird, that if the skeleton had been found minus the feathers, the comparative anatomist might reasonably have described the fossil as belonging to the Reptilia, though it possessed some distinctly bird-like characters. The first specimen found possessed a long reptilian vertebrated tail of twenty-one joints, with one pair of quill-feathers attached to each vertebra; whereas in all modern birds the feathers are arranged like the sticks of a fan, with the large feathers folding upon one another.

Archaeopteryx (Greek for ancient wing), as this bird was named, had a bird-like head and a bird-like brain; but its jaws, or beak, instead of being of horn, as in modern birds, were provided with sharp reptilian teeth. It appears that the head and neck were devoid of feathers, but the legs were equipped with quill feathers. The wing retained three fingers with reptile-like claws, and the bones of the palm (metacarpals) were free from one another. The fingers had the same number of joints as are found in lizards. The vertebrae were biconcave, as in fish and some reptiles. The breast-bone ("keel") was but slightly developed; whereas in modern birds the keel is relatively large, affording abundant room for the attachment of muscles. *Archaeopteryx* was a poor flyer, probably using its primitive wings for gliding or soaring through the air. (The *Pterodactyl*, or flying reptile, which developed quite differently, was a far better flyer than the earliest true bird.)

Here, then, we have another non-missing link, a transition stage in the evolution of dinosaur-like reptiles into birds as we know them.

EVOLUTION LOST

Evolution was put out of business in a debate held January 31st in City College, Detroit, between Dr. Newman Dorland of Chicago and Harry Rimmer of the fundamentalist Research Science Bureau. One of our readers, A. D. Latham, reports:

"Mr. Rimmer produced fossils to prove that the evidence of Paleontology contradicts the evolution theory; named so many various strata formations in California, Mexico, Alaska, Europe, etc., where the oldest is on top and the newest on the bottom or all mixed up that geological disturbance was not acceptable; said there is not a particle of biological evidence to show transmutation of species and hurled a defi at science to prove it. He spent half an hour to show how ridiculous the vestigial theory is and wound up with a peroration to the effect that science first forms an opinion and then misinterprets facts to fit that opinion.

"A vote was taken. Needless to say, anti-evolution won by a majority of 1500 against 20 for evolution."

This was not in back-woods Tennessee, but in a metropolitan community of the "intelligent" North. Those evolutionists who think that Darwinism is already universally accepted and that there is no need for a publication such as this will have a rude awakening some of these days.

"TENNESSEE"

— or —

"They Can't Make a Monkey Out of Me"

(Fundamentalist Ditty)

I'm from good old Tennessee,
I'm a plain out-spoken man.
I go to church on Sundays,
And do my neighbor when I can.
This world wus made in seven days,
The good book tells us so:—
If anyone doubts it, scoffs or flouts it
We all know where he'll go!!

They're tryin' to upset the his'try
Of how the world began:—
They've got a thriller
That a big goriller
Wus the ancestor of man.
Did y' ever hear such a fool idee?
It seems unfair to me:—
For my face is pale and I've got no tail,
And I've never climbed a tree!!

Refrain

Oh! the things they do
And the things they say
Won't go in Tennessee!
They can shout, they can hoot
They can evolute
In some other state maybe.
When they say I come from monkeydom
They insult my family tree!!
They can teach, they can preach,
They can get up an' screech,
But not in Tennessee;
An' I'm goin' to shout
'Til I drive 'em out,
For they can't make a monkey out o' me!!

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DEBATE IN NEW ORLEANS

W. B. Riley of the World's Christian Fundamentals Association and Charles Smith of the American Association for the Advancement of Atheism will debate under the auspices of Delta Gamma Sigma Lecture Bureau in Jerusalem Temple, St. Charles Ave. and Clio Street, New Orleans, March 14th and 15th.

The question for the first evening is: "Is Evolution a Fake Philosophy?" The second: "Should Evolution Be Taught as An Established Science in Tax Supported Schools?"

Readers having open minded friends in New Orleans will confer a favor by sending us their names and addresses so that we may mail them sample copies of EVOLUTION in advance of this debate.

SLOW EVOLUTION VERSUS FAST EVOLUTION

By ALBERT DUY MCNAIR

THE Darwinian theory of evolution assumes that scores of millions of years and perhaps hundreds of millions of years have been consumed in the process of evolution from the lowest forms of life to the highest. As far as man, himself, is concerned, evolutionists believe that a million years, more or less, have passed since man became really man.

Those who object to this theory of evolution on biblical grounds, say that they do not believe in evolution at all although admitting that minor changes have occurred in man, animals and plants since they were first created. They admit that there are many varieties of the human species, of cattle, dogs, deer, oak trees, pine trees, clovers, etc., and they admit that these varieties have taken place by certain natural processes.

In taking the Bible as their standard of authority on this matter of the variation of animals and plants they are also committed to other consequences of the biblical story. If the biblical story of the Flood has any real historical meaning, it means that all species of land animals and plants that are on the earth today have descended from the pairs that were preserved in the ark about 4000 years ago.

Also the biblical story that snakes were made to go on their bellies after the serpent tempted Eve, involves the idea that they did not go on their bellies previous to that time, and involves the further conclusion that all present snakes, including the poisonous and non-poisonous kinds, have grown their differences in 6000 years.

In regard to other animals, if we classify them as "lumpers" instead of "splitters"; if we make the number of species so few that the ark could have held them, then we make the variations in 4000 years such as would, according to the real evolution theory, require millions of years.

It follows from the foregoing that those who object to the theory of evolution on biblical grounds really believe in a more rapid change in animals and plants than do the Darwinian evolutionists. They may call this change by the name of variation or development or something else, but it is evolution just the same.

Has any one seen Negro children or Esquimaux children born from white parents, or white children born from Negro or Esquimaux parents? The differences between these races must have come about by some process of change, development, or evolution, or call it what you will. How long has it taken for these differences to develop? According to the evolutionists it has taken hundreds of thousands of years. In the case of whites and negroes it may have taken a million years. According to the opponents of evolution, it has all come in 4000 years.

It comes, then, to this: The Darwinian evolutionists believe in slow evolution, their opponents believe in fast evolution.

CHARLES DARWIN: THE MAN AND HIS WARFARE. *By Henshaw Ward.* Bobbs-Merrill Co.: $5.00.

It was decidedly appropriate that Henshaw Ward should write the story of the Father of Evolution, for his "Evolution for John Doe" placed him securely near the top of the list of those who can make this subject interesting and understandable for the mythical man in the street; and, as was to be expected, he has here given us now not merely a readable biography but a human document that presents its subject as a real, living character—simple, lovable, painstaking, but always the scientist.

If only those who prate about evolution as a guess could be induced to read this story of a man's patient investigation, careful study, and cautious judgment, to say nothing of his physical handicaps, they would certainly be shamed into silence. How ridiculous their puny ravings in the light of Darwin's ceaseless devotion to scientific truth!

Darwin's procedure, says Ward, was to ask, "What do you make of these facts that I observe?" And he observed for an ordinary life-time before venturing to a conclusion. Here we have the account of his travels, interesting and romantic as a novel, the introduction to his long search for facts; and then we are shown how his ideas correlated with the events of his life.

There have been many erroneous statements about Darwin and his conclusions, and many misconceptions. One was the notion that he changed his mind and came to accept the Lamarckian philosophy. Mr. Ward pays his respect to those responsible for the spreading of such errors, including Dr. H. F. Osborn. With fine discrimination and accuracy of judgment and language the author examines the facts available and reaches apparently rational conclusions on all these disputed points.

Not the least interesting part of the book is that which relates how the "Origin of Species" was received, how the conservatives gathered for the onslaught under "Soapy Sam," the Bishop of London, and how they were met in the arena by Huxley. Ward says, "The hurricane of wrathful hypocrisy that burst upon Darwin in December, 1859, is perhaps the most simian exhibition that the human race ever made of itself."

Needless to say, this is a book that is recommended without reservation for the readers of this publication.

HARRY HIBSCHMAN.

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I keep six honest serving-men
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And *How* and *Where* and *Who.*
Rudyard Kipling, "Just So Stories"

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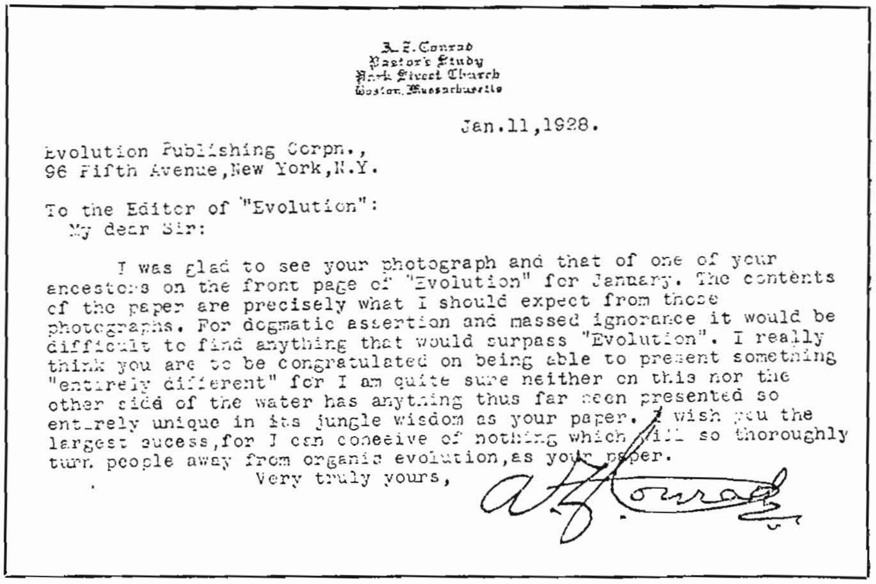

A. Z. Conrad
Pastor's Study
Park Street Church
Boston, Massachusetts

Jan. 11, 1928.

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To the Editor of "Evolution":
My dear Sir:

I was glad to see your photograph and that of one of your ancestors on the front page of "Evolution" for January. The contents of the paper are precisely what I should expect from those photographs. For dogmatic assertion and massed ignorance it would be difficult to find anything that would surpass "Evolution". I really think you are to be congratulated on being able to present something "entirely different" for I am quite sure neither on this nor the other side of the water has anything thus far seen presented so entirely unique in its jungle wisdom as your paper. I wish you the largest sucess, for I can coneeive of nothing which will so thoroughly turn people away from organic evolution, as your paper.

Very truly yours,

A Z Conrad

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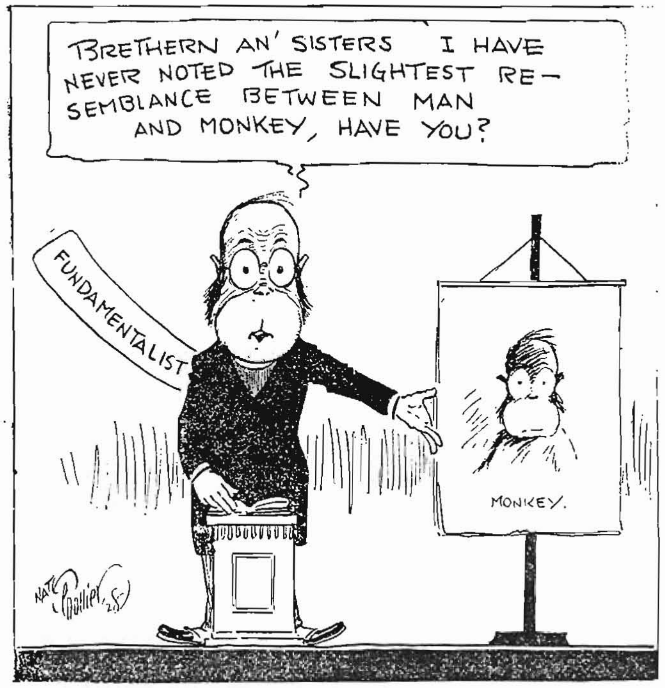
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FUNDAMENTALIST
MONKEY.

IN THIS ISSUE:

ALLAN STRONG BROMS: Formerly Science Lecturer, Twin Cities Workers University Society.

GEORGE A. DORSEY: Author "Why We Behave Like Human Beings" and "The Nature of Man".

HOWELL S. ENGLAND: Pres. Michigan Rationalist Assn.

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J. C. TH. UPHOF: Head Dep't Biology, Rollins College.

HENSHAW WARD: Author, "Evolution for John Doe", "Darwin, The Man and His Warfare", etc.

J. LEON WILLIAMS: Author and Science Lecturer.

JOHN M. WORK: Edit. Dep't, Milwaukee Leader.

THROTTLING THE SCHOOLS

Shipley reports that two thirds of rural schools prohibit teaching evolution. This is no accident. The September issue of the Fundamenatlist Defender explains how it is done:-

> "Tax payers may play an important part by demanding of their local school boards that only those teachers be engaged who are openly and without hesitation opposed to evolution.
>
> "Notice, I say 'openly opposed', for many people repudiate evolution with their lips when questioned, but retain mental reservations. Make sure that your money, as a tax-payer, goes only to pay the salaries of teachers who reject the beast theory in its entirety. Let there be no half-way business!
>
> "The responsibility must rest with individual taxpayers, working through their school boards, until such time as a sufficient number of people can be awakened to the seriousness of the situation and demand action on the part of legislative bodies."

WHAT WILL YOU DO

about this effort of fundamentalism to throttle the teaching of science? Here is a convenient blank on which to make appropriate answer.

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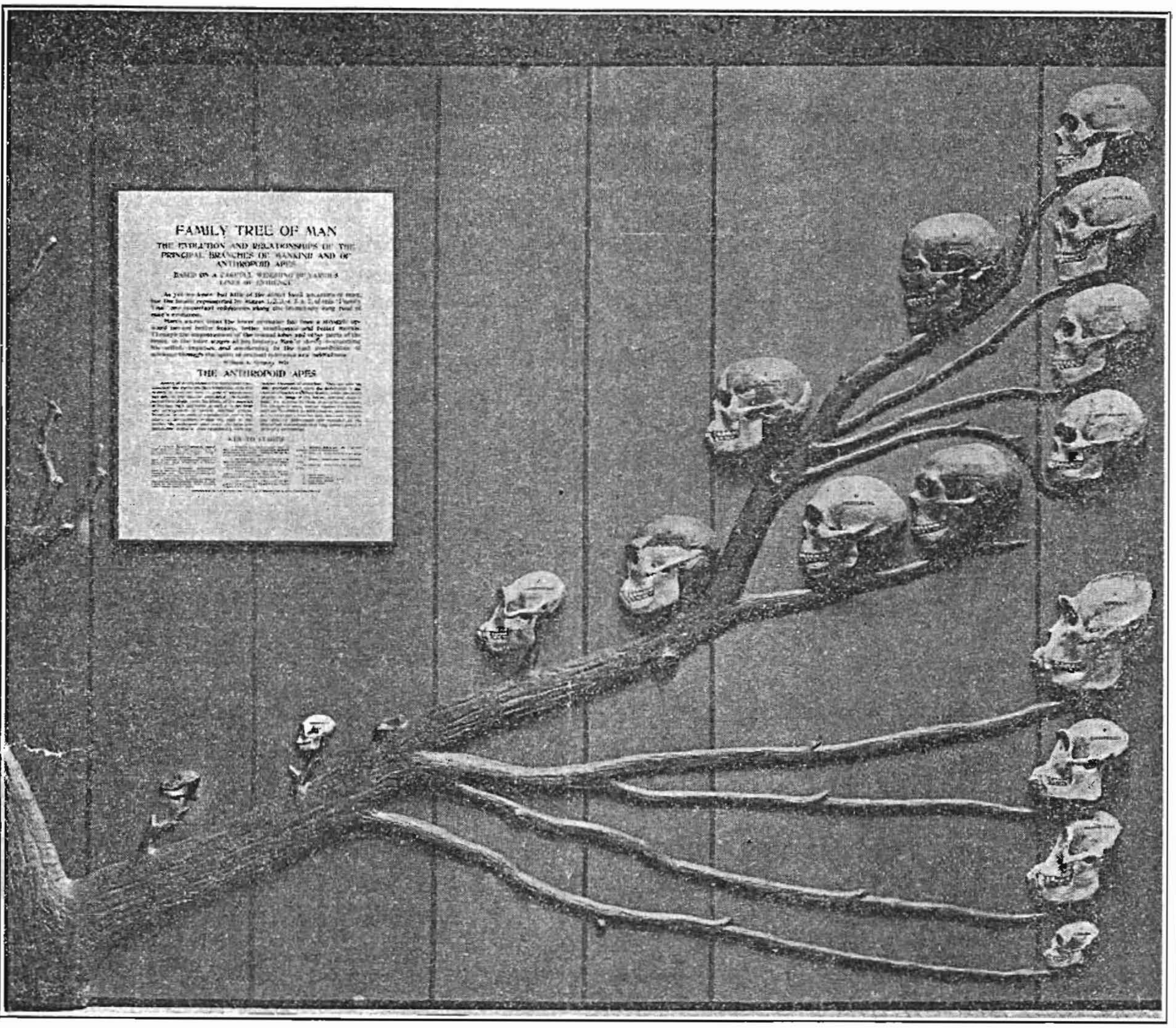

FAMILY TREE OF MAN
THE EVOLUTION AND RELATIONSHIPS OF THE PRINCIPAL BRANCHES OF MANKIND AND OF ANTHROPOID APES
THE ANTHROPOID APES

Courtesy of American Museum of Natu ral History

1. Primitive Primate
2. Prototypal Anthropoid
3. Primitive Anthropoid
4. Trinil Man
5. Piltdown Man
6. Heidelberg Man
7. Neanderthal Man
8. Cro-Magnon Man
9. Australian Blackfellow
10. Hottentot
11. Chinese
12. American

A. Gorilla, Africa
B. Chimpanzee, Africa
C. Orang-utang, Borneo
D. Gibbon, India

FAMILY TREE OF MAN

By Wm. K. Gregory

The Maze of Species

By HENSHAW WARD

THERE is one simple reason why a non-scientist may find it hard to believe the evolution theory: he knows nothing about the infinite number of variations within the species of plants and animals. He supposes that a "species" of animal is a fixed, clean-cut department of life which can always be identified; he supposes that the difference between an animal and a plant is a definite and impassable barrier; he supposes that a "species" of plant is a peculiar sort of organism which a botanist can always recognize.

But the truth is just the opposite: it is difficult to draw a dividing line between plants and animals; most species have variant forms that link them with other species; within every widely-distributed species there are endless variations. The biologist has to believe in evolution because he finds that every flourishing family of organisms is a maze of interlaced forms which would be a disorderly nightmare if it were not for an evolution theory.

I will present some illustrations from botany.*

How many kinds of mosses have you ever heard of? If we had never seen but ten kinds, we could rest with the supposition that they were originally created so; but when we learn that there are sixteen thousand species of these inconspicuous growths and that the more common of the species have varieties that grade off insensibly into varieties of other species, then we can not be content with any such guess at the cause. The more a botanist becomes familiar with the countless varieties of plants, the more certain he feels that he is dealing with some sort of continuous growth of the whole system of organisms. A few dozen different ferns would never have excited a Wallace or a Darwin to cudgel his brains for an interpretation of nature; but the four thousand five hundred species that botanists now know might well cause an inquisitive mind to lie awake at night.

There are about one hundred thousand species of this lower division of plants. Of the higher division, the flowering plants, there are more than one hundred and thirty thousand species. Some of the items that make up the total are five thousand grasses, one thousand palms, two thousand lillies, seven thousand orchids, one thousand two hundred cactuses.

More significant than mere numbers is the way in which plants unlike in appearance are found to be alike in their anatomy and way of growing, so that kinds which are very dissimilar in all outward appearance are found to have inwardly a decided family resemblance. Thus elm trees, fig trees, nettles and hops are found to have such similarity in their flowers that they belong together. The figs include such apparently unlike plants as the rubber tree, the banyan and a vine-like parasite. In another great group the botanists have been obliged to lump together geraniums, flax, oranges, mahogany and castor beans, because they are similar in their ways of propagating. The scientists have no desire to do queer things; they would much prefer to say that rubber trees and milk-weeds are alike because of their milky sap; simplicity has always been their aim. But nature has made it impossible for them to find any simple way of classifying. It is as if she had strung the most diverse forms on one thread of structure, and had then so looped and tangled the thread that the botanists are taxed to their wits' ends to straighten it out in anything like orderly sequence. When a man has labored for thirty years at this effort to untangle related forms, he comes to think of plant life as a labyrinth, and he demands a clue. What will guide him? His work would be easier if he could discover that all the crisscrossing forms were originally created as distinct kinds of organisms. but the opposite conviction is continually thrust upon him—namely, that all plant life has forever been altering in character, putting out changes here, there and everywhere.

The puzzle would not amount to much if a species were always a species—if, for example, a certain kind of pine tree were everywhere the same. But within any species there may be endless variations, some of them amounting to striking differences.

An illustration is a certain small grass growing commonly in the United States and Europe, *Draba verna*. When samples of this are gathered from different parts of the world, it is found that there are many distinct types—no less than two hundred have been counted, each of which will breed true from seed. Each of these types, the so-called "varieties", might be called a species. Any naturalist who cares to cultivate the varieties can breed new ones; he can, as it were, watch the plant branching out into new forms. A botanist in Amsterdam once counted seven hundred varieties of hyacinths. It is estimated that American florists have caused fifty species of irises to branch out into one thousand five hundred distinct varieties, that they have developed as many forms of roses, and that there have been produced in the gardens of the world no less than eight thousand varieties of roses. The great Dutch botanist De Vries says of hawkweed:

"Thousands of forms may be cultivated side by side in botanical gardens, exhibiting undoubted differentiating features, and reproducing themselves truly by seed."

What shall a naturalist conclude after he has spent studious decades in watching these ceaseless fluctuations of countless forms of plant life? What shall he think when he takes stock of this medley of life, this unmapped chaos of contradictions and relationships? He has no chart or compass until he adopts the evolution theory; with it he can always steer a course.

---

* Taken from *Evolution for John Doe*, Pages 24-26.

The earth has her boundaries, but human stupidity has no limits.—*Gustave Flaubert.*

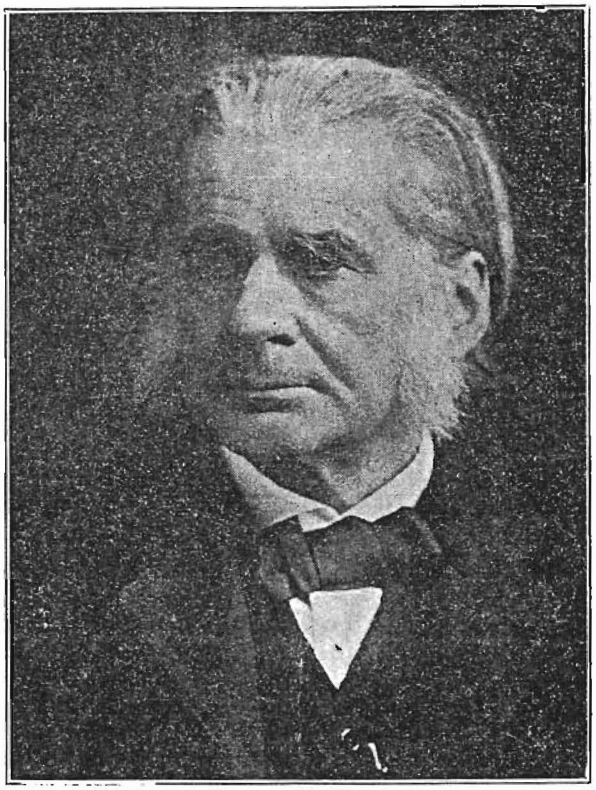
Logical consequences are the scare-crows of fools and the beacons of wise men.—*Thos. Huxley.*

Thomas H. Huxley and Peter Kropotkin

By ALEXANDER GOLDENWEISER

THE advent of evolution was like the explosion of a bombshell in a hostile camp. The adherents of the doctrine of the immutability of species, the representatives of orthodox theology, all those—among scientists, laymen and clergy alike—who had vested interests in these doctrines, were up in arms. Once more dogma and complacency were shaken unto their very foundations.

In an emergency such as this courage, energy and enthusiasm were needed to take up the cudgels for the new doctrine. These qualities were possessed to a remarkable degree by Thomas H. Huxley, eminent biologist in his own right, friend of Charles Darwin and Herbert Spencer. He took up the fight where Darwin had left it. Eminent divines and silver tongued prime ministers like Gladstone presently found their biblical quotations and oratorical firebrands countered by uncompromising facts from the biological laboratory buttressed by logical rigor. Huxley was a fighter. What Darwin had done in his *Descent of Man* with caution and timidity, Huxley did in his *Man's Place in Nature*, an outspoken and merciless pamphlet, in which he brought together the evidence of comparative anatomy, embryology and physiology, to the effect that man was but the last link in the animal chain, that the differences between man and the anthropoid apes—the gorilla, chimpanzee, orang-utang and gibbon—were slighter than those separating the anthropoids from the monkeys. There was no gainsaying these carefully marshalled facts. In his Darwinian essays, given as lectures to groups of workingmen, Huxley was spreading the new doctrine among the wider groups of the semi-educated.



THOMAS H. HUXLEY

At the fighting front caution is thrown aside and limiting "buts" and "ifs" are easily forgotten. This happened in the case of evolution. The doctrine of natural selection as sponsored by Huxley, assumed the character of a struggle to the death in nature, a struggle of tooth and claw, in which the weaker perished and the victors survived over the dismembered bodies of their victims. Darwin had never intended to emphasize the struggle element to such an extent, especially not the feature of its ferocity. But the picture drawn by Huxley had dramatic appeal and it was taken up by less scrupulous popularizers who distorted it still further. From that time on the biologically inspired doctrine of struggle, in which the weak perished and power conquered, exercised a sinister influence on sociological and political thought—as, for example, in the doctrines of Cumptowics and his disciple Ratzenhofer, the Austrian sociologists. The struggle of men and nations for survival, for conquest, was but a sequel of that vaster struggle always carried on in nature in the form of natural selection.

This exaggeration of the Darwinian theory was countered by Peter Kropotkin, anarchist, geologist and amateur biologist, in his fascinating book *Mutual Aid in Evolution.* In the pages of this remarkably detailed and erudite study, Kropotkin pointed out that the other factor in biological progress, a factor lost sight of in the Darwin-Huxley theory, was co-operation, mutual aid. Through co-operation weaker animals such as wild horses, asses and goats, managed to survive and multiply in the face of the depredations of their more powerful preying foes. Kropotkin also made the important point that the "struggle" was not so much between species and species, as it was of animals against nature, physical environment, climate, and that it was in this latter kind of struggle that the fitter survived. Not satisfied with having demonstrated the importance of mutual aid in the animal kingdom, Kropotkin carried his researches further into the field of primitive society and thence to the cities of medieval Europe and modern workers' co-operatives. Kropotkin's well documented and brilliant book serves as a necessary counter-poise to the one sided distortions of the original Darwinian doctrine.

"The only question which any wise man can ask himself, and which any honest man will ask himself, is whether a doctrine is true or false."—Thomas Huxley.

* * *

"Whatever happens, science may bide her time in patience and in confidence."—Thomas Huxley.

"Thoughtful men, once escaped from the blinding influences of traditional prejudice, will find in the lowly stock whence Man has sprung the best evidence of the splendor of his capacities; and will discern in his long progress through the Past a reasonable ground of faith in his attainment of a nobler Future."—Thomas Huxley.

How Man Differs From The Ape

By BERNHARD J. STERN

II. PSYCHOLOGICALLY

"ARE apes and monkeys our poor relatives?" asked Doctor R. R. Marett, the English anthropologist in a recent lecture. His answer: "I think myself that it would be snobbery to deny it."

It has been a common feature of such snobbery to glorify man and his abilities and achievements at the expense of the anthropoids. Various *unique* abilities and powers have been attributed to man that are also present among our poor relatives. And when one reads Koehler's *The Mentality of Apes* and Yerke's *Almost Human* one comes to the conclusion that these relatives are not as poor as we have thought them to be.

For example one hears repeatedly that "man is the only tool-using animal". Anyone that knows anything at all about the behavior of the apes will deny this. Put some bananas beyond the reach of a chimpanzee and have a stick in the vincinity and you will observe how quickly the bananas will disappear in the stomach of the animal. The ape will use a box, a pole, even the back of a man to get some coveted bananas that are too high for him to reach. He also uses straws and twigs for spoons and for catching ants.

"But," says the reader who has been raised in the conceit that he alone can use tools, "Is not man the only tool *making* animal?" Not even that is man's *unique* ability. Koehler indicates effectively how the ape too creates tools. The outstanding instance is that when an ape broke off a branch of a bush and used it to obtain his food. No more can we use that dramatic but hackneyed opening sentence of the legend of man "That moment when our primitive forefather broke a branch from a tree and made it into a club he became human."

There are wide psychological implications in the manufacture of the tool described above. It dispels another of the *unique* powers attributed to man—that of abstract thinking. For to perceive the possibilities of a stick in a bush is to distinguish between a part and a whole which is an advanced type of abstract thought. And of course, the use of tools of any sort implies purposeful thinking, that is, directing behavior for a certain end.

Memory is another of man's supposed attributes which the ape is thought not to possess. But this too is incorrect. Careful observation and experiment has proven that the ape does remember and even associates unconnected objects, as for example where a stick was put twelve hours previously in order that he might get some bananas outside his reach that are particularly tempting to him at the moment.

The greatest and most popular conceit of man in regard to the apes is man's idea that the ape *apes* him. Apes do *not* ape anything they do not understand or comprehend. When a man makes a fool of himself before the ape's cage at the zoo, he is deceiving himself if he thinks that the ape is performing any antics that he would not do were the man not there. The acts which were thought to be an imitation of man are performed by apes who have never encountered a Homo Sap.

What then is the distinguishing feature between man and the ape? It is the fact that man has an articulate language. The ape has this only in a very rudimentary form. Learned recognized thirty-two sounds or elements of speech relating to food, drink, to other animals and persons. But man's well developed articulate language which is itself a learned trait, has enabled him to transmit and accumulate knowledge from generation to generation. Through it he has been able to build a culture which has enabled him to transform his environment and which in turn transforms him.

"Is This Me?"

By GEORGE A. DORSEY

SEX is biologic; it has a natural history—like the bones of our body, or the cells of our brain. Civilization is quite another affair—human history writ large. Man can mould, change, alter, destroy civilization, but sex and human nature are in the blood, part of our natural inheritance. To understand ourselves and our civilization, we must know that civilization has come to be what it is because we are what we are. What are we?

Man is not what he thought he was. His own dogs bark at him. Like the old woman who woke up in the market-place and found her petticoat cut off to her knees, he asks: Is this me, or isn't it? And if not, who am I?

Men and women make Man. The Psalmist exclaimed in awe: "Lord, what is Man?" "Lord, what is Man not?" asks Hewlett scornfully. Neither attitude gets us anywhere. Nor did our calm complacency of a few years ago. We even boasted of our power over Nature. We did not know that it was loaded. That "power" burst—filling our body with shrapnel, befogging our mind with the fumes of poison gas.

Reaction: nations demand new bombers; Man, new remedies—the old ones have lost their kick. Both demands are met: new explosives, new prescriptions. Some would prescribe for human nature as if it were a disease, to be cured in six weeks with six bottles, or with a new set of glands!

Is that it? Is it Man's nature that is ailing? But to cure it—six weeks? In 60,000 years, possibly. If the past is any guide, Man can no more "cure" his nature than he can pull himself up by his bootstraps.

Perhaps Nature will cure him. Perhaps. But not soon—Nature takes her time. She allowed the Elephant two million years to lose one tusk, the Horse a million years to lose one toe. She gave Man five million years to lose his tail; we carry around five bones of it yet. A half-million years ago she stood Man on two feet; our bodies are not yet adjusted to an upright gait.

It is curious that Man trusts his voice to the telephone and his family to the motor car, while he still clings, like the poet's vine to the moudering wall, to his ancient notions about his own nature. It was more than 200 years after Man knew that the earth revolves once every twenty-four hours, that he discovered his own blood completes its circuit every twenty-three seconds. He can predict comets, but not wars, famines, or elections. He knows his Ford's viscera better than he knows his own. He rears calves more intelligently than he raises children. He does not know why he suffers from rupture or drops dead of heart-failure; or that he has hare-lip because there were Sharks in his ancestry, and cleft palate because he is of the line of Amphibia and Reptiles.

East is East and West is Europe, said Kipling, thereby insinuating grave error. But had he said that Susie O'Grady and the Chinese lady are sisters under the skin, he would have served truth. What we should like to know is: why is their skin different? Or why an East, or a Chinese lady—or women at all? And if Man's nature is incurable, are his habits? Or is Man the only dog that cannot learn new tricks, the only machine that defies law, the only animal that cannot be understood?

What are we? Before we can answer that question we must know something of our physical body: what it is, where it comes from, who made it, what it is good for, what is its upkeep. Why so many sizes and colors; will the color fade; is one color, size, or sex better than another? Why do so many fail before they are used up, why do they wear out at all? Is it coming or going, is there likely to be a new model out soon, and will it be better (and if so, in what respect), or cheaper?

When we know this body of ours we begin to know what we are—and that will help us to understand why Man made culture and why we call our culture Civilization and think it pretty good. It will also help us to understand why the old lady who lost her petticoat in the market-place got frightened when she discovered she had legs—and why her dog barked at her.

X-Rays Stimulate Variation

Below we reprint from "Science" of January 27th, 1928, an abstract of the paper by Dr. H. J. Muller of the University of Texas presented before the Joint Genetic Sections of the American Society of Zoologists and the Botanical Society of America, at their Nashville meeting. Awarded the American Association Prize of one thousand dollars for the most notable contribution to the advancement of Science. We hope to have a less technical presentation of this tremendously important subject soon.

"THE EFFECTS OF X-RADIATION ON GENES AND CHROMOSOMES" (*Abstract*)

THIS paper reported the author's experiments of the past fifteen months on the hereditary effects of X-rays applied to the fruit fly, *Drosophila melanogaster.* By means of special courses, the discrimination of mutations in individual genes from genetic recombinations of various sorts (due to segregation, non-disjunction, etc.), was facilitated, and lethal as well as visible changes were rendered detectable. Results in the second and later generations, based on several thousand cultures, showed that gene mutations had occurred in the most heavily treated germ cells at about 150 times the frequency of those in the controls, derived from the same source, while in germ cells less heavily treated the result was intermediate. Germ cells in all stages studied were susceptible to the effect: these included oögonia, ova, spermatozoa shortly before fertilization, and spermatozoa when rayed either in the male or in the female receptacles six or more days prior to fertilization.

The induced mutations resembled spontaneous ones, inasmuch as: (1) The great majority were lethal; of the rest most, but not all, reduced viability or fertility. (2) Recessives greatly outnumbered definite dominants. (3) Many of the visible effects were relatively inconspicuous. (4) Though "new" mutations were somewhat more frequent, there were also numerous repetitions of familiar mutations. (5) All regions of the chromatin were affected, but the induced mutations were more densely distributed in those regions of the linkage map in which more spontaneous mutations have occurred. (6) Multiple allelomorphism occurred. (7) So also did reverse mutation of genes already mutant when treated. The two latter facts argue against the effects always being complete losses or inactivations. (8) Though point-mutations were the rule, there was an occasional "line-mutation" involving a row of neighboring genes, as if by an electron that had passed parallel to the chromonema. (9) The vast majority of the treated genes, both mutant and normal-seeming, remained stable in their inheritance throughout succeeding generations, though at least one case of an "eversporting" condition arose.

Evidence was secured (by making use of non-disjunction) that only one of the two identical genes, or allelomorphs, present in a diploid cell, is caused to mutate at a time. The effect on a given gene, in a haploid germ cell, is "fractional," in that only a fraction of the resulting embryo will receive mutant gene material, the remainder being of normal gene content. Since there is no evidence of an indiscriminate intermingling of the mutant and normal tissues thereby arising, it becomes unlikely that the gene is compounded of many interchangeable members. This is also evidenced by the stability of treated genes in heredity.

Besides gene mutations, frequent rearrangements of gene order—involving inversions, translocations, duplications, etc., of chromosome sections—were found, by genetic evidence, to be produced by X-rays. These provided information concerning various questions. For example, cytological verification of two such cases yielded direct evidence for the physical validity of the linkage maps and of the corollary theory of crossing-over.

Spheric Mirror Shows Human-Ape Relationship

By A. L. Herrera

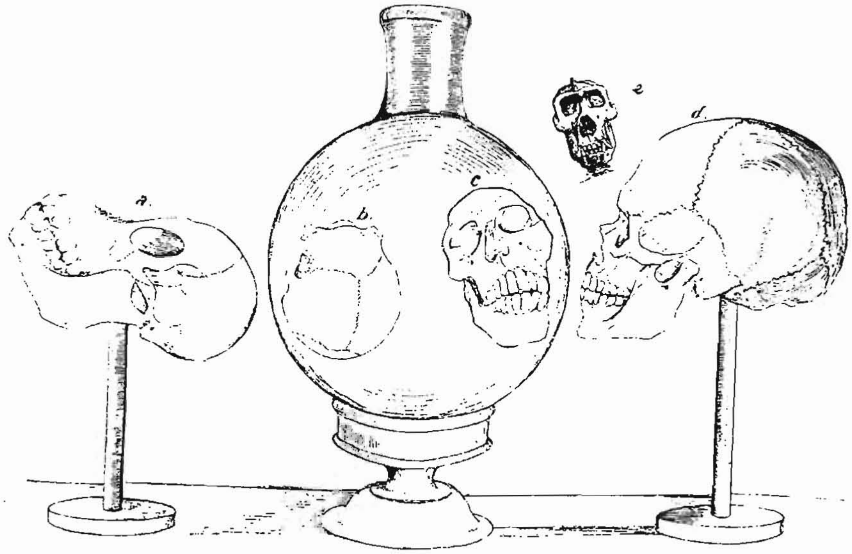


Fig-1

THE study of the distortion of natural objects as reflected by a spheric mirror is instructive. It exaggerates details of structure and form in such a way that insignificant differences are remarkably accentuated, and discovers the reciprocal relations of organic forms, their common and differential characters. It confirms many of the presumptions of the theory of evolution and discloses some important facts of morphogeny. In some cases it even allows us to foresee the results of artificial selection and cross-breeding.

In a spheric mirror, the nearer the object is, the bigger is the image. The size of whatever is farther away from the mirror is aparently reduced. Thus a kangaroo may acquire the normal aspect of a mammal having four legs of the same size. If its head and fore-limbs point toward the mirror its long hind-legs are apparently shortened. And thus the size of an ibis' beak whose base is held toward a curved mirror diminishes so that it assumes the shape of the normal bill of a small bird.

It is a plain and practical manner of demonstrating the old law of Geoffrey de St. Hilaire, or organic compensation.

As shown in the drawings (Figure 1) the orang-outang's skull (a) reflected in a spheric mirror (a glass of liquid air), with its maxillar region as far as possible from the reflecting surface, assumes (b) the aspect of a brachicephal human skull. The maxillar region could not be shown satisfactorily in the drawing, but any one can try the experiment and see that the maxillary and dental prognatism disappears completely.

Figure (d) shows a normal human skull placed before the mirror so that the facial and maxillar regions may appear larger. The result (c) is worth notice. It becomes the image of an ape's skull. Compare it with (e), the Gorilla skull. Note its big oblique orbits, very narrow forehead, well marked maxillar and dental prognatism, and bent back chin. It looks very much like the skulls of fossil men; its general aspect is beastly and very far from human.

We can see here how the development of the occipital part and of the vault of the cranium in human skulls reduces, by organic compensation, the facial and maxillar parts. This even indicates that supermen will have an enormous cranial vault and atrophied maxillaries.

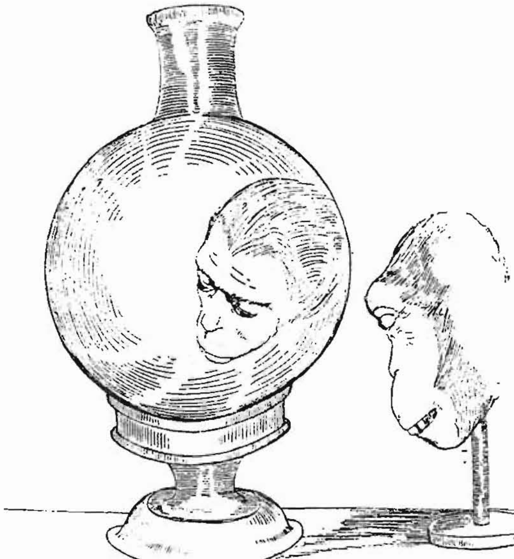


Fig.-2.

The second figure is a chimpanzee's head modelled in wax. It seems human as reflected by the mirror. (Figure 2).

This demonstrates that the gap between man and ape is small, and that a mere compensation of growth in certain directions is sufficient to bridge it.

Evolution and the New Perspective of Life Purposes

By HARRY ELMER BARNES

THE evolutionary conception and the new cosmology are as disruptive of the accepted views of man as they are of the older theological attitude towards God. According to the accepted biblical theory, man was a theological entity and not a unit of bio-chemical behavior. He was important chiefly as the custodian of an immortal soul, for which his fleshly being served merely as the temporary envelope pending the earthly experiment which determined the destiny of each individual soul. In the more optimistic passages of Holy Writ man was defined as only a little lower than the angels, while in the more abject strains he was viewed as but a worm of the dust.

HARRY ELMER BARNES

The scientific facts reveal man as neither a worm nor an angel with pruned wings. He is the leading member of the simian group and therefore the dominant element for the time being in the animal kingdom. This view of man as an animal has been extremely repellant to many of the more pious and conventional brethren, but there is little rational ground for such an attitude, once it is understood what one really means by this. When one views the situation in a scientific and common sense attitude, he recognizes that the animal kingdom represents the highest order of life on the planet; that is, the highest level of development known to man. Therefore, to be the temporary leader of the animal world is the highest form of achievement to which man could possibly pretend and this title is the superlative praise which can possibly be bestowed upon him.

Further, not only is the conception that man is an animal a demonstrated fact in no way humiliating to the human race; it also has much more practical significance. If it were known to be true that we are slightly mitigated angels, this would afford no clue to the study of mankind, because no one has seen an angel and we possess no knowledge of the personal traits and behavior patterns of the angelic host. On the other hand, once we come to recognize the fact that man is an animal we immediately have the rich field of comparative anatomy, physiology and psychology to draw upon and from which to build a solid approach to the study of human nature and behavior. These branches of science reveal man as a super-simian, and the study of simian psychology, as summarized in such books as those by Kohts, Koehler and Yerkes, affords more in the way of a key to human behavior than all the books on theology ever compiled from the days of primitive folklore to the most abstruse apologetic manual of a contemporary professor of systematic theology. Even a humorous and avowedly trivial little book like Clarence Day's "This Simian World" will tell one more relevant and cogent things about human nature than all the ponderous tomes of an Aquinas or the collected sermons of a dozen Moodys or Spurgeons.

The implications of the above for sociology and ethics are very great and far-reaching indeed. It comes down to this, namely, that the type of behavior and institutions which are best suited to advance human happiness and efficiency must be sought and constructed in conformity with the need of a species of super-simians inhabiting diverse types of geographic environment.

The implications of contemporary astro-physical discoveries, together with the parallel progress of research in biology and anthropology, have necessitated a complete revolution in the accepted views of the purpose of life. This earth can no longer be regarded as a temporary training-camp, preparatory for life in the New Jerusalem. rather, it can be rationally regarded at present in no other way than as a place in which a man should make himself as happy as possible during his temporary existence here upon earth. Not only must the objectives of human life be reduced to a secular plane, but we must now definitely enunciate and defend "the right to be happy." To be sure, we may concede at the outset that happiness need not be identified with the tastes and achievements of Casanova, Fatty Arbuckle or the "Old Soak," though they may be as safe and desirable guides as Calvin or Immanuel Kant. We must formulate a conception of happiness which will be sufficiently comprehensive and well-grounded. Perhaps, as a statement of general principles, we can do no better than to revert to the one great previous effort to formulate ethical principles on secular foundations, namely, the ethics of the Greeks, and particularly to Aristotle's conception of virtue as the "happy mean." But we can go further than the Greeks in transforming this generalized formula into terms of concrete guidance through our present day knowledge of biology, psychology and sociology.

"NO MAN ever had eyes less hampered and more assisted by his mind than Alexis De Tocqueville; born in an age which buzzed with theories, he could nevertheless see what he looked at; he believed what he saw in a day when most people only saw what they believed."—From *The Villager*.

EVOLUTION

A Journal of Nature

To combat bigotry and superstition and develop the open mind by popularizing natural science

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PUSSY-FOOTING

In the report of Austin H. Clark, News Manager of the recent Nashville congress of the American Association for the Advancement of Science we find the following illuminating observation:

"Certain aspects of science in the recent past have given rise in Tennessee to a considerable amount of controversy, and it might have been expected that at this meeting the local papers would seize the opportunity of reviving the discussion. Nothing of the sort occurred. On the contrary, the local papers handled a delicate situation in such a masterly way as to give a new broader meaning to the phrases of southern courtesy and southern hospitality."

A year's free subscription will be given as a prize to any reader proposing a better name for this than "Pussy-footing."

BELOW THE BELT

John Roach Straton, fundamentalist preacher, achieves notoriety no matter where he orates. Just now he is reported to have "struck another vigorous blow at evolution" in San Jose, California.

And of what consisteth this "vigorous blow"? Hath the Reverend Doctor conducted experiments or observations to disprove any one of the myriad items of evidence for evolution accumulated through the painstaking labor of legions of scienticts all over the world? Listen to the Great Divine:

"Consider Hickman. What did Hickman study in school? Did he study the Bible? No, he studied evolution."

Of course, if Hickman had studied evolution it would prove exactly nothing at all in this connection. But the fact happens to be that Hickman was very religious, saw the "will of God' in all that he did, and prayed constantly to get out of trouble.

From here it looks like this John Roach follower of the lowly Nazarene is *hitting below the belt.*

CONFIDENTIAL QUESTIONNAIRE

The following questionnaire has been sent to every College and University President with the notation that "answers are for compilation only and will be held in strict confidence. If you wish to comment for publication, please use separate sheet. Kindly return before March 25th, so that we can compile the answers for our April issue."

1. Is evolution taught in your institution?
2. Is it taught as fact, or as mere theory?
3. Do YOU consider evolution a fact?
4. Should teaching evolution be prohibited by law?
5. Shall we send our magazine, Evolution, to your library regularly?

Enough answers have already been received to assure that the compilation will be most interesting and instructive. It will be made a feature in the April number of Evolution and should achieve a wide circulation among students as well as teachers.

JUST A WORD

The printing of a signed article does not necessarily mean its endorsement. The editor does not presume to limit this journal to articles with which he agrees, but also prints others that he thinks would be interesting to the readers.

Our advertising columns are open to organizations and concerns that are "on the square". We shall never knowingly permit any fake or misrepresentation. In this we ask the co-operation of our readers.

EVOLUTION DINNER

The Evolution Dinner will take place at 6:45, Friday, the Thirteenth of April, at Cafe Boulevard, 132 West 41st Street. Mark this in your note book right now if you are within hailing distance from New York. For of course you'll want to be there to get acquainted with the writers and some of the other supporters of Evolution.

There will be a symposium on "The Evolution of Evolution". No long-winded speeches. Limit: five minutes. Some splendid music. Also "eats".

So plan to bring some friends. The rate will be $1.75 per person. Please make reservation as long in advance as possible,

FRIDAY THE THIRTEENTH

Friday the Thirteenth of April is the first anniversary of the chartering of the Evolution Publishing Corporation. Will you send a Birthday present to this lively kicking infant in the form of some new subscriptions? And perhaps also a contribution to help broadcast sample copies? We hope to be remembered This month by Every reader.

IN THE BEGINNING

Two tiny cells unite, surrendering
Their individualities, to bring
A new-born entity to life; and so
The lunar cycles glow and dim and glow;
While Nature, for the millionth time,
resolves
The mystery of HOW mankind evolves.

The single cell divides and multiplies,
And passes through a thousand forms,
and dies
A thousand deaths of change, and yet
survives
Till, at the end of half a million lives,
Nature completes the sum of it, and flings
Her proved solution to the World of
Things.

"Here is the heir of all that was", says she,
"And here the sire of all that is to be!"
They cut the cord, draw the placenta
through,
And go to tell your father that it's YOU!

—C. H. M.

A DINNER IN YOUR CITY TOO?

Mr. O. O. Whitenack of the Colorado Rationalistic Association writes:

"At the same hour you are feasting in New York and planning to get the scalps of the bigots we are going to have a dinner in Denver in honor of your great magazine and the gospel it proclaims. We hope the same will be possible in other cities. Professor Shipley should be able to send his greetings from the Pacific coast and Mr. Steiner should have a meeting in Chicago.

"At about seven oclock that evening (9 p. m. New York time) we want to exchange greetings with you by telegrams, messages that will express to the world what we stand for and what we hope to accomplish.

"Neither of us is to let the other know the message we are to send, but it must of course bear upon evolution and the magazine. We will let you know what details are arranged as soon as possible."

This is truly a splendid idea. Similar dinners might be arranged in every city for Friday the Thirteenth of April, wherever there is an interested group of Evolution readers, to celebrate the birthday anniversary of the Evolution Publishing Corporation and make plans for the struggle against fundamentalism in their communities.

Details, such as addresses where dinners are to be held, hour and price, names of responsible persons, speakers, etc., should reach us by March 25th if possible, to be published in Evolution.

Every reader is invited to help make Friday the Thirteenth of April a tremendous nation-wide demonstration in favor of the freedom to learn and teach whatever science discovers.

Write us your plans right away. But do not wait for approval. Follow the splendid example of our friends in Denver and Get Busy.

What Evolution Means to You

By MAYNARD SHIPLEY

THE evolution concept is not merely one of the grandest generalizations of science; it is also of real practical significance, not only to the fathers and mothers of the children who must attend our tax-supported schools, but also to every citizen in his own right. It has an important bearing, on every problem that we have to face.

Maynard Shipley

At this point I can imagine some even of the readers of EVOLUTION saying to themselves: "Well, I know that evolution is an important scientific concept, and I believe it should be taught in our schools, but what do I personally care about it? Evolution doesn't butter any bread for me!"

Some months ago, as president of the Science League of America, I received a letter from a very well-known medical man who practises in one of the southern states. As a graduate of one of our great medical colleges, he is, of course, an evolutionist. But he expressed the opinion that it was not necessary that our boys and girls should be taught biology—the science of living beings. He did not claim that biology could be properly taught with evolution left out; he knew, as all real students of science know, that it could not. But he asked if the time devoted to the natural sciences in our schools could not, to better advantage, be given to some useful art or trade.

But why the antithesis? Why not give at least a small part of the time to the science of healthful and enlightened living, along with the art of making that living? Why devote *all* of a pupil's time to business methods or business ethics or to learning a trade—in short, to making money? Is money-making an end in itself? Or is not the making of money merely a means to a higher end—namely, the rounding out of a wholesome, comfortable, helpful, sane, and beautiful life?

Why, indeed, should not all boys and girls be taught at least the elementary principles of biology and geology and astronomy (all of which, I repeat, are dependent on evolution for their proper understanding)? We teach them the best in literature, something of the world they live in and its history, the easier parts of mathematics, a little of art and music, perhaps some foreign language: but too many of us think a boy or girl can be "educated" who knows nothing whatever of the great basic foundation of all modern life—science.

Perhaps few would deny that we owe the best that modern culture affords to "all the children of all the people." Tomorrow they will be voters, who may be called upon to decide whether biology and geology (which necessarily involve the processes of evolution) shall be taught at all in twentieth-century America. Above all, our children must learn that all contemporary investigation is firmly based upon the evolutionary concept, and that this concept touches upon every phase of modern life—even including personal hygiene and public health.

Not only is the evolution concept necessary to a real understanding of the natural sciences, but it is essential in every branch of human welfare—in plant and animal industry, in medicine, surgery, geology, zoology, psychology, human origins, child study, criminology and penology—in short, in every department of human knowledge. The great progress of applied science today in America is entirely dependent for its continued growth on freedom in pure science. If you destroy the root, the tree will fall.

Among the most treasured books in my library is a work by Charles Darwin—a volume which was used for a period of thirty-five years by that greatest of experimental horticulturists, the lamented Luther Burbank. It was because of his close study of the works of the immortal Darwin that he was able to give to the world not only hundreds of new flowering plants of unexcelled beauty, but also new fruits, vegetables, and cereals which have added hundreds of millions of dollars to the value of products of the soil.

It is obviously the duty of all who appreciate the patient and painstaking workers in field and laboratory, to aid in the protection of freedom in research and instruction. It would be humiliating, indeed, to be a citizen of a state or country where science was shackled and despised; but, more important still, it would also be dangerous to public health and welfare.

It has well been said that "if there is any method of insuring that what is taught is true, better than that of giving investigators and teachers the utmost freedom to discover and proclaim the truth as they see it, that method has never been discovered. If those who know most about a subject sometimes decide wrongly, matters are not likely to be mended by putting the decision into the hands of those who know less."

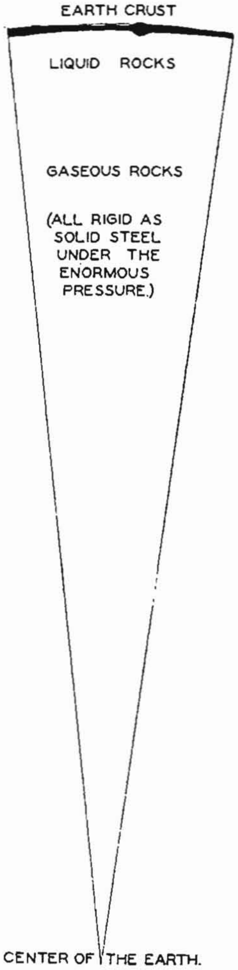
While it is well known that not one living biologist, geologist, botanist, zoologist, palaeontologist, or anthropologist, of recognized standing in his profession, anywhere in the civilized world, doubts that things came to be what they are found to be, by a process of evolution—of orderly change under immutable natural laws—nevertheless, what the friends of science are really supporting (or trying to protect) is not so much this unanimous conclusion of the scientists, as the validity of the method on which it is based, the *method of science*, and the moral right and duty of the workers in field and laboratory to make known to the students in our tax-supported educational institutions the full results of their researches. Science commands our respect, not on the basis that its present conclusions are absolutely and for all time true, but on the ground that its *method* is for all time true—the method, not of tradition or revelation or authority, but of discovery, careful observation, research, experimentation, comparison, testing, analysis, synthesis. We want to know, not what somebody said that someone else said, many centuries ago, perhaps, but, precisely: "What are the present facts in the case?" These facts, as fast as discovered, must be set in order, then interpreted or accounted for; not in accordance with tradition or unsupported logic, but in accordance with all the knowledge at the moment available. Our boys and girls are entitled to the full benefits of this method—the method of science.

We sometimes hear it said, "But scientists change their conclusions; what the pupil learns today may be invalidated tomorrow." To a certain—and a very limited—extent this may be true; in other words, science is not static, but grows as more and more is found out by research. But once the pupil has been thoroughly grounded in the scientific method and attitude, these changes will only add to his knowledge as they are revealed to him. He has hold of the basic principle, and is prepared to receive and understand each new discovery as it is made, and each new conclusion as it is formulated. A generation educated in even the most elementary principles of science would find this world a far more interesting, more healthful, and more reasonable place to live in, than one where the inhabitants had grown up in ignorance of this foundation of all progress.

Evolution is the one and only scientific conception which "serves to give unity and direction to the study of human culture as a whole."

How Old Is the World?

By ALLEN S. BROMS



A slice of the earth according to the Radiactivity Theory

GOING down a deep well or mine-shaft, one would find the ground temperature rising steadily,—about one degree Fahrenheit for each fifty feet of descent. At this rate, the temperature at twenty miles below the surface would be sufficient to melt some of the rocks. At the center of the Earth everything would be, not merely liquid, but gaseous, though the enormous pressure of the overlying rock matter would keep the whole mass (solids, liquids and gases) as rigid as if made of solid steel. Only a very thin outer crust would be solid because it was cool.

I daresay the Fundamentalists would explain all this as due to "fire and brimstone" and picture (with more or less holy self-satisfaction) that eternal abode for us evolutionists in which we are doubtless to occupy the most scorching place of honor. I fear, however, that we must disappoint by rejecting this pious explanation in favor of one that is sensible.

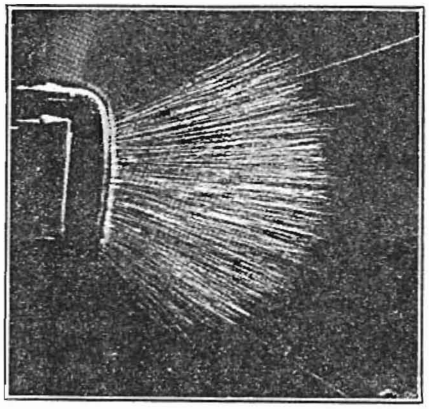
Earth Heat From Radioactivity

Chemical analysis of various kinds of rocks from all parts of the Earth reveal the fact that practically all contain minute portions of the radioactive elements uranium and thorium. By a series of steps, these elements finally break up into helium and lead, the helium being shot out most violently (see illustration). Heat is thereby released, slowly, but steadily. As we can readily measure how fast heat is given off by each element and we know quite closely the amounts of the elements in the rocks of the Earth it is a simple matter to determine whether enough heat is given off to account for the temperatures found underground, keeping in mind that much earth heat slowly works its way to the earth surface and is then lost by radiation into outer space. We find that not only is enough heat thus produced, but *too much.* This would indicate that the Earth is not cooling off, but actually getting hotter. Thereby, we shall find, hangs a most interesting geological tale.

Previous Age Estimate Too Low

On the opposite assumption, that the Earth was gradually cooling off from an original molten state, Lord Kelvin had estimated the age of the Earth at 40,000,000 years. All he had to do was to measure the rate at which the earth heat was being radiated into space, make due allowances for higher rates at higher temperatures in the past, and figure how long it would take to cool it from the molten state.

Geologists claimed that his estimate was too low. They had studied the rates at which sediments were being deposited, they knew what miles upon miles of sedimentary rocks had to be accounted for, and they found forty million years too short. They determined the rates at which streams were cutting and lowering continental surfaces and about how much of this had been done in the past, and again the time allowed was too short. They measured the saltness of the oceans (particularly the sodium content) and how fast the rivers and shore waves were removing the salts from the rocks to the seas, and they concluded that the oceans themselves were more than 100,000,000, perhaps even 175,000,000 years old. Of course, this would make the Earth itself much older.



Tracks of Helium Atoms shot out from Thorium

Heat of the Sun Explained

Until the discovery of radioactivity, the heat necessary to keep the Earth warm for such a long time could not be explained. The heat from the Sun, though it makes a lot of difference at the surface of the Earth, does not penetrate very deeply below that surface. Besides, it had been taken into account. In fact, it presented just another difficulty, for from what source was derived the enormous amount of heat being radiated by the Sun? If the Sun were solid coal, it would all be burned out in a few thousand years. A theory of heat from contraction extended the time to a few million years. But the heat from radioactivity multiplied this into billions of years, in closer agreement with what we know of the age of the Earth.

A Peep Into the Geologic Future

In the Earth itself, it was found that the heat from radioactivity more than offsets the loss into space and that the Earth is therefore probably getting hotter. Some of this heat reaches the surface and promptly escapes into space, but the temperature deep down inside is slowly rising, for the earth-crust acts as an excellent blanket in keeping the accruing heat inside. Professor Joly has carefully figured the rate of this heat accumulation and concludes that in some thirty to forty million years the temperature will rise high enough to melt and weaken portions of the earth crust. If this is true, then eventually the lid must blow off.

What happens when the lid blows off is another story, to be told in the next article. Only one effect need be noted here. According to Joly there ensues a period of rapid heat release so that within six to twelve million years quite all the accumulated heat would be lost. Then the earth-crust blanket would settle down again to its job of holding the heat accumulating for the next great cycle. Every forty to fifty million years these great cycles would repeat themselves. And as we have good reasons for believing that five or six of these cycles have occurred in geological times, we can again estimate the age of the Earth,—roughly between two and three hundred million years, which agrees fairly well with the best estimates from other evidences.

Evolution and Evolution Theories

By WALTER C. KRAATZ

MANY well-intentioned but much mistaken people regard evolution (customarily called the theory of evolution) as merely theoretical and as synonymous with Darwin. Of the many ordinary misconceptions met with by one teaching biology, this one of identifying Darwinism with evolution is one of the most widespread and persistent. Countless times is the mistake corrected in the numerous courses given and in the books on evolution for student and laymen, and still the idea sticks, to the confusion of many, who therefore are in doubt about the solid establishment of evolution itself.

Naturally if one were to approach the subject without biological background and without plan or system read some older evolution books, including the greatest classics of evolution for all time, the works of Darwin, he would quite possibly not differentiate the two things, because he would be going through a lengthy enumeration of facts tending to demonstrate evolution, and at the same time, getting most pointedly the constant explanation of evolution by natural selection as given by Darwin. In the popular mind and also in the careless words of some science writers, evolution is identified with Darwinism. It should not be done, even though Darwin is the greatest figure in evolutionary biology and did more than anyone else to establish evolution, as well as offer about the most acceptable explanation or causal theory that has been offered. Some do not agree to his causal theory of natural selection, but they are nevertheless staunch evolutionists. Evolution should no more be regarded as synonymous with Darwinism than gravitation itself might be defined as synonymous with Newtonism (if we may use the term).

Any modern evolution textbook will present this matter in a systematic way.

Evolution, the name for the ages-long gradual development of the wonderful multitude of animal and plant species, is an overly large subject to learn comprehensively. We will not discuss it in this little article, but merely see what fields of evidence there are, what groups of numberless facts in nature have established it, and then this little list of fields of evidence will allow us to differentiate sharply from this other subject of theories of evolution, that is, theories of explanation of the mode of evolution.

There are many fields within the biological sciences that offer overwhelming demonstration for evolution. They comprise: morphology or comparative anatomy, classification, embryology (the pre-birth or pre-hatching part of the individual's development), paleontology or the study of fossils, which is the study of the countless relics of the ages of life succession on the globe, geographical distribution of animals and plants, the blood tests, domestication, and some other experimental botanical and zoological lines of research. It would take a series of articles to explain these even very briefly. Everyone who has learned some considerable amount of this evidence realizes that evolution is a fact, or better termed, a natural process or natural law.

But what is the mode of evolution or what the process? How does it go on? By what means is it working? Just what are all the factors deep-seated in nature, and how do they correlate to make all the new species of animals and plants? This is a great problem, not entirely solved. This is obviously a different inquiry from that of the evidences for evolution itself. Evolution is history. The meaning of the phrase *theories of evolution*, is not the history itself but the inherent things that cause and accomplish this particular succession, or cause this history, of new organisms.

To answer or attempt to answer the problem of the mode or method of evolution, or the cause of origin of new species, has been the work of many biologists, and has been worked up together with the accumulation of evidence of the fact of evolution. Underlying these explanations or theories are some absolutely fundamental factors, namely heredity, variation, and selection.

The most important theories that have been promulgated, without reference to their present standing are: Lamarck's theory, sometimes called the theory of use and disuse, which is the oldest scientific theory of evolution worth noting; Darwin's theory, the theory of natural selection or survival of the fittest, which can be called Darwinism correctly; De-Vries's theory or mutation theory; the orthogenesis theories; isolation theories, and others, some of which are best in correlation with others.

The important point in this connection is that difference of opinion with respect to any or all these theories has not the slightest effect on evolution itself. All biologists—and everyone worthy of the name is meant here, not some teachers in fundamentalist colleges who may warp their biology to suit their fundamentalist masters—accept evolution, though they may be arguing about Darwinism, De-Vries's mutation and Lamarckism.

The public so often confuses the two, evolution, and these theories of evolution. In newspaper articles, particularly in the glaring, ambiguous headlines, they are confused time and time again. Disagreement over some detail of the causal theories of evolution, denial of Darwinism or of Lamarckism, is wrongfully misinterpreted as denial of evolution. It is high time that purveyors of news and opinion and the public at large get this matter carefully in mind.

SHARES AVAILABLE

The EVOLUTION PUBLISHING CORPORATION, organized under New York State laws, offers its $10.00 shares of 6% preferred stock. With every five shares of preferred one $10.00 share of common, voting stock will be given, if paid by April 13th.

The immediate business is publishing this journal, EVOLUTION and selling books. Later a Lyceum Bureau for touring natural science lecturers will be developed.

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Additional capital furnished now will help make the circulation campaign for EVOLUTION magazine a success. Checks should be made payable to EVOLUTION PUBLISHING CORPORATION. In remitting kindly state whether payment is made in full, or whether it should be applied on a larger block of stock to be held until balance is paid.

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Of course you'll show this issue of EVOLUTION to your friends and ask them to subscribe. But you probably know some who would be interested, whom you can not visit yourself. Send us their names and addresses and we'll mail them sample copies.

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Funnymentals

"I. We believe in the Scriptures of the Old and New Testament as verbally inspired of God, and inerrant in the original writings, and that they are of supreme and final authority in faith and life.

II. We believe in one God, eternally existing in three persons, Father, Son and Holy Spirit.

III. We believe that Jesus Christ was begotten by the Holy Spirit, and born of the Virgin Mary, and is true God and true man.

IV. We believe that man was created in the image of God, that he sinned and thereby incurred not only physical death but also that spiritual death which is separation from God; and that all human beings are born with a sinful nature, and. in the case of those who reach moral responsibility, become sinners in thought, word and deed.

V. We believe that the Lord Jesus Christ died for our sins according to the Scriptures as a representative and substitutionary sacrifice; and that all that believe in Him are justified on the ground of His shed blood.

VI. We believe in the resurrection of the crucified body of our Lord, in His ascension into heaven, and in His present life there for us, as High Priest and Advocate.

VII. We believe in "that blessed hope", the personal, premillennial and imminent return of our Lord and Saviour Jesus Christ.

VIII. We believe that all who receive by faith the Lord Jesus Christ are born again of the Holy Spirit and thereby become children of God.

IX. We believe in the bodily resurrection of the just and the unjust, the everlasting felicity of the saved and the everlasting conscious suffering of the lost."

Confession of Faith of Worlds Christian Fundamentals Association, reprinted from February 1928 number of its official organ.

EVOLUTION VERSUS THEOLOGY

Maynard Shipley, evolutionist, and John Roach Straton, fundamentalist, debated March 7th at the Civic Center Auditorium in San Francisco.

Approximately five thousand people, mostly fundamentalists, attended and fervently applauded their speaker, and boohooed science and evolution.

Upon leaving the auditorium an apparently intelligent person was heard to remark: "I never before believed that man descended from monkey, but since I have seen five thousand people fervently applaud fundamentalism, which has given us nothing, and attempt to boohoo science, which has given us everything, I am thoroughly convinced that man didn't descend from monkey, but that he still is one." *J. Baxter*

NEWS FROM ARKANSAS

Although the Secretary of State in Arkansas writes that no petition has been filed with him as yet, we have definite report that the fundamentalists have already secured enough signatures to their petition to place the question of evolution on the ballot in Arkansas at the next election.

EVOLUTION ON THE AIR

Maynard Shipley, President of the Science League of America, is giving a series of talks on evolution over the radio (Station KFRC, San Francisco) at 4 P. M. Pacific time on alternate Thursday afternoons, March 15th, 29th, etc.

Readers of EVOLUTION having followed Mr. Shipley's splendid articles in this journal will surely be delighted to hear him, and to ask their friends also to listen in. Let Station KFRC know that this is appreciated.

AND NOW KENTUCKY

Representative Hobbs of Wolfe and Powell Counties, Kentucky, has just introduced an anti-evolution bill in the Kentucky General Assembly. This body voted down an anti-evolution bill in 1921 by 42 to 41, and again defeated the proposition in 1926. But since then the Fundamentalist Bible Crusaders, Ku Klux Klan, etc., have been active in Kentucky and the outcome this time is by no means assured.

MY ANCESTORS

At work or play from day to day
I dream of them serenely,
Not just as folks are thought to dream
Of forbears quaint and queenly;
Of Kings and Lords, with crowns and swords,
The artists are but jesters,
But of the sort that science says
Were likely our ancestors.

I watch my wife, with fork and knife
And all her house utensils,
Or at my desk I take account,
Of papers, books, and pencils;
And quick as scat, all this and that
Has vanished quite completely,
And I am some perplexed to tell
The simple truth discreetly.

My wife is there, dressed just in hair
And hide, to put it plainly,
Or rather I should say, my wives;
I try to blush quite vainly,
If that is me I humbly see
Rubbing my nose, and scratching
In the inimitable way
Of monkeys who are matching.

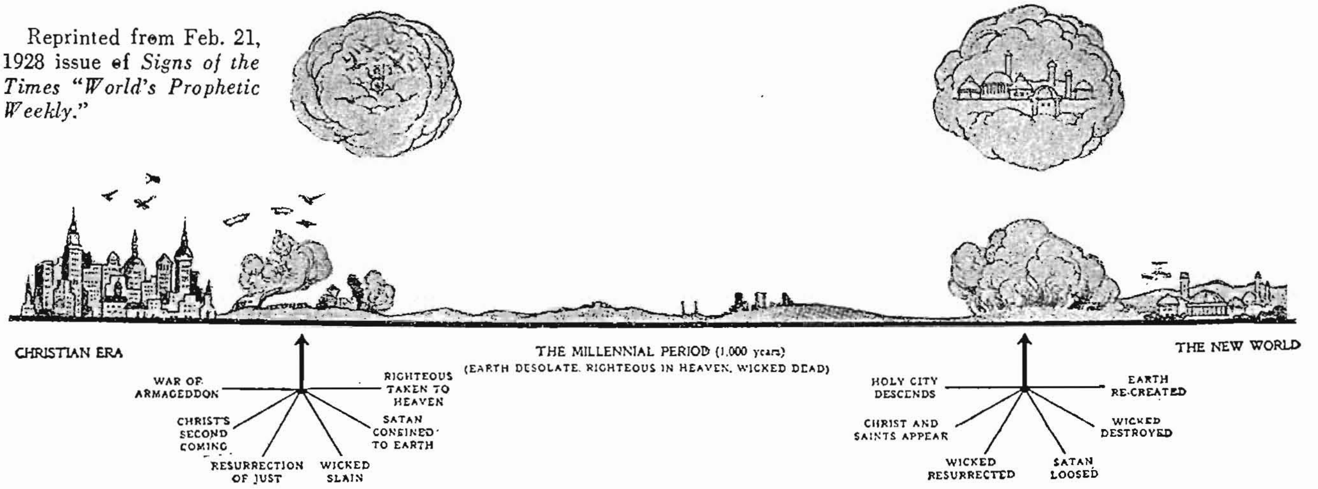
On every hand the monkey band
Are in a merry riot;
They live, these ancestors of mine
Upon a simple diet;
They do not work, they do not shirk,
Nor go to church on Sunday,
And as they have no clothes to soil
They never wash on Monday.

They have no creeds, no title deeds,
Nor lawyers nor physicians;
No flags or governments to breed
A pest of politicians:
They have no cooks, they have no books,
No landlords and no tailors,
No soldiers and no serving-men,
No preachers and no jailors.

My ancestors, and also yours,
However we deny them,
Whether for better or for worse
Our present ways belie them:
I wonder much at such and such,
By decent folks defended,
And sometimes feel too sure that man
Is from the ape *descended*.

—ROBERT WHITAKER

Reprinted from Feb. 21, 1928 issue of *Signs of the Times "World's Prophetic Weekly."*



A Greater Danger Than Evolution

By CLEVELAND SYLVESTER SIMKINS

A FAR greater danger to the established dogmas of religious intoleration than evolution lies in the chemical analysis of the phenomena of life. This field is new and the startling discoveries already made are quite unintelligible to the censoring angels of American morals, education and the Statue of Liberty. Just now the fundamentalists are awakening to the somnambulant delusion that Darwin and Nietzsche are responsible for the doctrine of evolution, sixty-five years after the appearance of the "Origin of Species", and three thousand after the first hint of an evolutionary process, hence it may be reasonable to predict that a hundred years more and we shall be forbidden to experiment upon the living cell because it writes the chemical formula of the soul and proves that life is a physio-chemical process.

This myriad I, composed of units below the range of naked vision, labors to produce my individuality from fertilization to the grave. Even Christ was wrong for the lilies of the field toil and spin, though rooted to the spot. We die, so does the lily of the field. but the chemical substances and physical forces undergo their transformations even after death; perhaps they pause, but rather does it seem as if they rise again to keep the living things upon the earth potentially immortal. Each living cell possesses that capacity of potential immortality, for if isolated, fed and warmed and watered it will live on and on as an independent unit outside the body that nourished and differentiated it. The isolated cell respires, it breathes, responds to stimuli, conducts an electric current with varying intensity according to the condition of its vitality. I may slowly kill the cell and in its lingering death determine that the amount of carbon dioxide given off slowly falls as death o'er takes it, but never falls to zero. The electrical resistance decreases to the point of death, but never does it cease completely. Hence the process of death, of vitality and reactivity presents mechanisms that can be measured and investigated by accurate means. The mechanism of life and death contains no vital principle, no *elan vital,* no spiritual power nor mystic source of energy beyond the ken of man's intelligence or the penetration of his dissecting needle.

Those pioneer investigators who have progressed so far into the seemingly unknowable things of life, have passed beyond the outposts set up by evolution and boldly explore a new and fertile field, half hid from the eyes of the world. We are unprovoked by the searchers for the Holy Grail, because they know not what we do.

Stop us from teaching evolution if you will, that lies behind us, it cannot be eradicated nor beaten from the minds of scholars; naught can avail from its suppression for we shall turn to deadlier weapons still, since they are already in our hands.

OTHER WORLDS, *By O. J. Schuster,* The Christopher Publishing House, Boston, $1.50.

Good popularizations of science always delight me and I have been having a particularly good time reading Schuster's "Other Worlds", there being only one little fly in the ointment. The facts of general astronomy are correctly stated and could hardly be more condensed, yet his way of putting it all is so pleasantly lucid that one gets no impression of condensation. One takes brief, vivid journeys to strategic points on the earth, to the moon, sun and planets and finally a round trip of the high spots of the universe, travelling when necessary with the speed of light. Astronomy has always had a popular appeal, but the author has done so very well that even the long familiar subject becomes freshly marvelous.

There is just the remotest hint in the foreword that the author intends to repeat his performance in other fields of science. I hope so and invite him to. He has the knack and sticks to the facts —which are wonderful enough—so he qualifies fully by my standards.

But I have a complaint when he takes us aboard his "Magic Ship Mintaka". Human beings do not like to be patronized, and this device strikes me as distinctly patronizing. I dare say the trouble is that he really does nothing with it when he has created it. Had he romanced with it like a Jules Verne, I am sure I would have been satisfied. Had he introduced us to its mechanism, taught us to operate it, and had thrilling accidents happen to it, then one could be satisfied. But to go aboard a "magic ship," which he did not even picture, and then not to be permitted to run the darn thing, is quite too much. When I go on his next trip, I hope the old boat sinks. But in spite of it, this was a great trip.

A. S. B.

HONORS FOR FEBRUARY

The honors for the best sale during February again go to R. Walsh of the Little Blue Book Shop, 3441 Woodward Avenue, Detroit, with 200 copies. Who'll beat this for March?

Fuming Fundamentalist (orating): "Do I look as though I descended from a monkey? Do I?"

Back Seat Wag: "You don't, Mister, for a fact. Tell us how it happened!"

SOME GOOD BOOKS

EVERY reader of EVOLUTION is *of course* also a reader of books. We recommend the following in their respective fields.

We shall also be glad to supply any other books at regular pulishers price. The commission we receive on book sales will help to broadcast EVOLUTION, but we'll share it with you.

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From Our Readers

"Please not to send any more.—*one* is enough. What we need in this world is not from what we are 'evolved', but rather, whither are we bound! Any science that helps to shake man's faith in the Eternal God, Creator of the Universe, is a menace to the best interests of the race." D. L. Ellis, Tennessee.

"My eyes fell accidentally upon the first issue of EVOLUTION. I found the first two issues interesting and good reading. But this last issue, February, much better. I find it excellent. I wish you would send me 25 copies for distribution.' C. Sahlin, Minnesota.

"EVOLUTION is great! EVOLUTION is *real*, because it adheres closely to the dissemination of facts of science, simply and cogently stated." E. S. Moser, Pennsylvania.

"You are putting across some strikingly fine things and I wish you great success." V. F. Calverton, Maryland.

"Your latest number of EVOLUTION is even better than its predecessors and meets the existing conditions admirably." Hugh F. Munro, Pennsylvania.

"I have viewed not without some alarm the recent movements against the study of evolution. The only remedy for this it seems to me is the better education of the public mind. I fully appreciate the fact that this is a slow and arduous task, but it is through such a magazine as yours, which is written so that "he who runs may read", that the portion of the public mind which has not yet learned to think in terms of evolution can best be approached." Leon E. Peeler, New York.

"Just received my first copy of your magazine and am well pleased with it. I want to help some, so I herewith send $1.00 for which please send me 20 copies for distribution." A. V. Bragg, California.

"You are doing a splendid work. Wish you every success in your undertaking. You may send me some more subscription blanks." V. Van Voorst, Missouri.

"I am enclosing my check for $2 to pay for 40 copies of February EVOLUTION. They sell like hot cakes at a dime a copy at the monthly lectures given here by Dr. John Emerson Roberts, who heads a Rationalist organization known as The Church of This World. The good Doctor announces that they will be on sale after the lecture, and they are all sold. I am glad to help the cause in this way." F. V. Schoolcraft, Missouri.

"Just a line to express my congratulations to you for EVOLUTION, which is a dandy little magazine well edited and deserving much success." Joseph Lewis, New York.

"I am greatly elated regarding the fine articles, and those who subscribed through my solicitation feel likewise. I fully realize the struggle in connection with a new publication. Success or failure for the magazine lies with the subscribers whose duty it is to obtain new subscribers. Taking the make-up and subject matter as a criterion for the future I predict success for EVOLUTION." H. T. Ahrens, Washington.

'Our greatest fault is stating a thing as a fact which may not be a fact, and which would not matter to us at present if it were a fact. There are enough things we KNOW to keep us busy. Whether a thing is a fact, doubtful, possible or probable, say so, if it is important enough to matter. Herein lies the error of fundamentalism,—except its big crime: denying free expression." P. B. Cowdery, California.

To use the human reason
Is "Fundamental" treason;
Just go it blind,
Leave brains behind—
Like tails, they're out of season.

Bob Lyle

LIBRARY FUND

Numerous Public Libraries have asked us to place them on our "Free List". EVOLUTION has no "Free List", and we have no capital with which to pay for subscriptions to be sent to libraries. However, we realize that this would be very much worth while, and therefore invite interested friends to contribute to a LIBRARY FUND.

Every dollar contributed to this fund will pay for sending EVOLUTION to two libraries for one year. For fifty dollars we will supply one hundred public libraries, and at the same time issue to the contributor shares in our Publishing Corporation for this amount. Who will start this ball rolling?

PITY THE HEATHEN

If EVOLUTION reaches only convinced evolutionists it isn't worth printing. Our real task is to carry the facts about evolution to those who do not understand what it is all about, so they can no longer be stampeded by fundamentalists. This we can do only with your help. Order a few extra copies to give friends and neighbors. We'll send you five copies each month for a whole year for only $2.50.

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By George A. Dorsey, Ph.D. LL.D.

Formerly Curator of Anthropology, Field Museum and Associate Professor of Anthropology, University of Chicago

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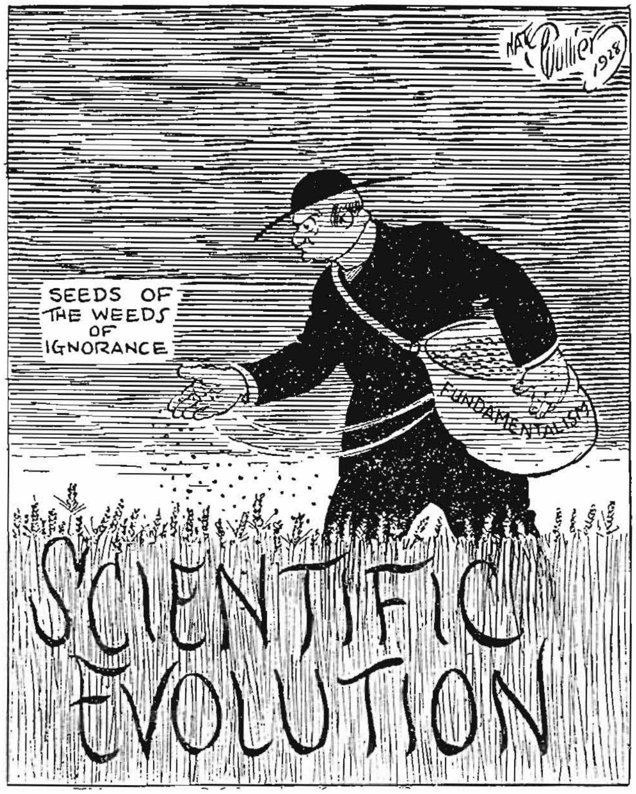

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ALLAN STRONG BROMS: Formerly Science Lecturer, Twin Cities Workers University Society.

GEORGE A. DORSEY: Author "Why We Behave Like Human Beings" and "The Nature of Man".

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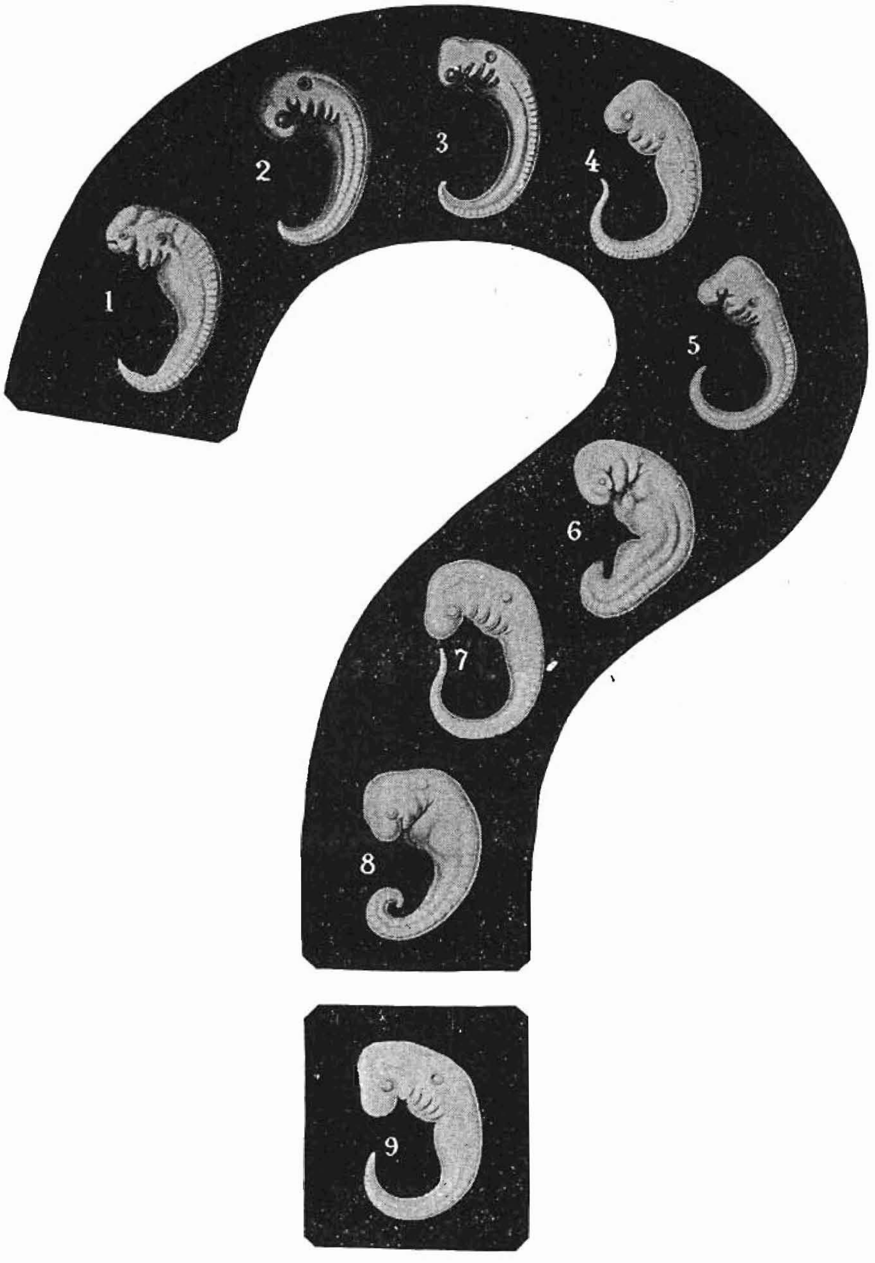


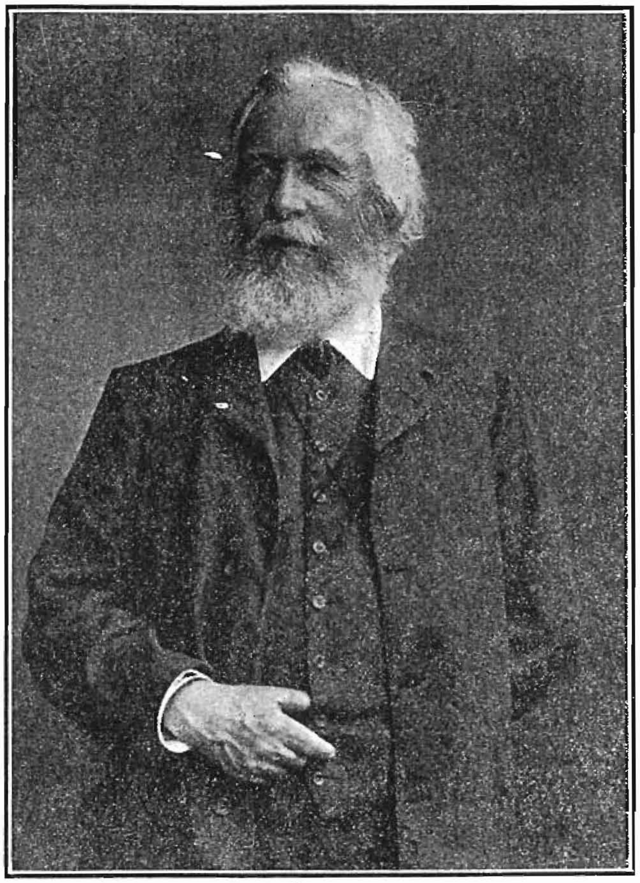
FIND MAN IN THIS PICTURE

ANSWER ON PAGE THREE

Ernst Haeckel and the Ontogenetic Law

By ALEXANDER GOLDENWEISER

IF Darwin was the father of evolution, Huxley was its war horse, but Haeckel, the great German Darwinian, was its knight in shining armor. Haeckel's greatest contribution to evolutionary theory was probably his "fundamental ontogenetic law" which stated that ontogeny recapitulates phylogeny. This meant that every organism in its pre-natal embryonic development recapitulates the stages through which the species of organism had passed in their phylogenetic succession.



ERNST HAECKEL

Haeckel's work on this subject was built on the foundation laid down by Karl Ernst von Baer, an Esthonian, who in his "Development of Animals" (published about 1828) first made known the facts upon which his own and later Haeckel's theory were based. Baer taught that the many specialized parts of the adult organism, such as the nervous system, the alimentary canal and the body wall, developed from embryonic leaf-like layers, four in number (by later investigation reduced to three), which were identical in all the higher animals. Baer also determined the chief stages of embryonic development, to wit: first the fertilized egg and its differentiation, then the germ-layers, and last the specialized tissues and organs. This sweeping generalization was fully borne out by later investigations.

While the details of Baer's theory were greatly modified in the course of the intensive biological researches of the middle nineteenth century, its basic kernel withstood the test of time. In his "General Morphology" (1866), Haeckel was able to set down the features of the ontogenetic law in forty-four theses of which the most important were the following: 1. The development of organisms is a physiological process, depending on mechanical causes, or physico-chemical movements; 2. Ontogenesis, or the development of the organic individual, is directly determined by phylogenesis, or the evolution of the organic stem (*phylon*) to which it belongs; 3. Ontogenesis is a brief and rapid recapitulation of phylogensis, determined by the physiological functions of heredity and adaptation.

Of these three theses, the second and third are accepted in all modern evolutionary biology, whereas the first has led to much discussion and controversy since the emergence of the vitalists (such as the Berlin embryologist, Oscar Hertwig, Hans Driesch the biologist, the philosopher Bergson and many others) who claim that the phenomena of life cannot be wholly explained by physico-chemical laws but require the postulation of a specific *vital* principle.

Haeckel, who was attacked on all sides — by scientists and theologians alike — spent much time and effort in elaborating and substantiating the second and third theses of his theory. In his "Studies of the Gastrea Theory" (1872-1877) he showed that in all tissue-animals, from the lowest sponges and polyps to the highest articulata and vertebrata, the multicellular organism developed from the same primitive embryonic form (the *gastrula*), and that this was the ontogenetic repetition, in virtue of heredity, of a corresponding stem-form (the *gastrea*). But Haeckel went further and in his "Anthropogeny" (1874) he illustrated the recapitulation theory on the human organism. In this work he attempted to explain the complex process of individual development, for the whole frame and every part of it, by causal connection with the stem-history of the animal ancestry of man. In the last edition of his book Haeckel demonstrated this theory with thirty plates, five hundred engravings and sixty genetic tables.

In answering his numerous critics, Haeckel also tried to make clear that the ontogenetic process must not be conceived as an exact duplication of the phylogenetic one, but that the former was an abbreviated recapitulation of the latter, complicated by condensation, disturbance or falsification. The biogenetic law, when properly understood, thus comprises two factors, one positive, one negative. The positive factor—*palingenesis*—reproduced a part of the original history of the st the negative factor—*cenogenesis*—disturbs or alters this picture in consequence of subsequent modification of the original course of development.

The ontogenetic law, in this amplified version, has become a common-place of evolutionary thought. When in the latter nineteenth century the social sciences fell under the spell of evolutionary ideas, much obfuscation and error resulted from an uncritical application of the law in the social field. It was argued, for example, that the psychic development of a modern individual recapitulates the psychic history of man from savagery upward and that savages thus become comparable to our children. A very silly notion this, for what is left out of account here is the nature of the historic process which is one of cumulation and accretion. Savage cultures are as historic and as old as our own and savages have children who—rather than their fathers—are quite like our children. An organic law of growth cannot be expected to apply to historic series which are based on the transfer and cumulation of tradition.

Let Man Do It!

By GEORGE DORSEY

TODAY no sea or land is safe from Man. Even at the dawn of history there were cities and civilization. Beyond that dawn—what of sea or land? Or of Man?

Sweep the ships from the sea. Clear the earth of human homes and cultivated fields, and restore the trackless forests. Turn the horses, cows, sheep, chickens, cats and dogs back to nature. Strip man of the last shred of his handiwork. Leave him nothing—no bow and arrow or spear, nor stone knife to cut a stick with or open a mussel shell; no light nor hearth, nor knowledge of making fire; no basket, pot, bucket or cup to carry water in; no mat to lie on, nor skin of beast to cover his body; no man-made thing at all, nor anything ready-made to do anything with; nor a friend in the world outside his own kin. Such was the untamed, unnamed world *our ancestors faced with* only their naked bodies.

Take a look at that body. It is ours—we need not be ashamed of it; if it grins we can smile back—and marvel that it did its work so well. It is work that counts—the work that man has done is the marvel; man's body is nothing much to look at.

Man could run, swim, jump, climb, dig—but not so well as deer, fish, flea, squirrel, mole; he could not fly at all. What could he oppose to wings of eagles, strength of elephants, teeth of tigers, fleetness of deer, venom of vipers, agility of monkeys? Mind? Mind alone is nothing. Intelligence? Intelligence alone feeds nobody, subdues nothing. There must be structure back of mind, mechanism for intelligence to work with; that was his physical body.

When man shot an arrow from a bow, he showed "human" intelligence. But he could not make arrow without that man-body; arms free to use the finest tools ever conceived, human hands; a brain full of cells to store up experience; a larynx fit to relate experiences, and ears attuned to hear the experiences of others.

With spear and arrow, Man suddenly had arms longer than the tentacles of a devil-fish. He need not run like a deer or dive like a whale—spear and arrow ran and dived for him! By a mere puff through a hollow tube, he sent a poisoned dart over the tallest tree. It made less noise than the wing of bee but could overtake and kill the swiftest bird; it was a fang as deadly as the viper's, a dagger longer than the sabre-toothed tiger's.

It had taken nature millions of years to invent poison fang, dagger tooth, elephant strength, and eagle wing. Having made man, nature said: Let man do it—let him run the world a while and worry and invent things!

Man accepted the challenge, and turned the job over to his wife; leaving her to care for the babies and the fire. He went a-fishing. There he met some cronies and organized the explorers club.

The world's work was begun.

Let man do it! Man was not new; he was different, he was superior, he had the equipment to do human things. He could hoe his own row, and row his own boat. And he had to. He was no little Tommy Tucker—to sing for his supper. He was still animal, and, like the animals, he had to root, hog, or die. Having no snout, he made a digging stick. But we, brave little Jackie Horners that we are, cry: What a great boy am I! We did not make the Christmas pie, we found the banquet set.

To set that banquet, every sea was sailed and every land explored—even before the dawn of recorded history. Beyond that dawn was man—insignificant in our eyes, and unsung; crude, rude. But he was man—he could ponder, he could worry. Without worry there would have been no progress; worry means a problem unsolved. He solved problems by inventing things. And nature let him.

TO FIND MAN IN THE PICTURE

Have you decided which one of the little figures on the front cover resembles you the most? They are the embryos of nine mammals at the stage when they have fish like tails and gill slits. Which one is the human embryo?

Do not be surprised that the question puzzles you. They are almost like peas in a pod. The embryonic development of man and other mammals goes through such closely similar ancestral stages that even scientific experts can hardly tell them apart.

These figures were taken from a brochure by Ernst Haeckel, "Unsere Ahnenreihe" (Our Ancestry), published in 1908. Haeckel explains that some of them were taken from his own collection, and some from various other scientific sources and that such soft and delicate objects suffer changes through the various methods of preservation and therefore do not correspond exactly. If all nine had been obtained at exactly the same stage of emryonic development and kept under exactly the same conditions, the outer similarity would be still more striking. The inner structures of all these embryonic bodies are almost exactly alike. According to the Biogenetic law, they bear indisputable witness to the "Monophyletic Origin of all Mammals" from a common root, a Pro-mammal of the Triassic Period.

So, after all, we will have to tell you which is which. The nine embryos are:— 1. Spiny ant-eater; 2. Opossum; 3. Hog; 4. Cat; 5. Bat; 6. Lemur; 7. Monkey; 8. Gibbon (Ape); and 9. Man.

The Origin of Mammals

By MAYNARD SHIPLEY

AS is well known, animals below mammals in the evolutionary scale are hatched from eggs in such a condition that they are ready at once to pick up bits of food and thus nourish themselves from the very start. Mammals, on the contrary, must be nourished (suckled) by the mother, even when hatched from eggs laid in a nest, as in the case of the Australian Duck-billed Mole.

We need not here enumerate the twenty-seven characters which distinguish mammals from all other classes of animals, important as these are to the student of zoology. For the average layman, the important point is that mammals are nourished by means of *mammae* (breasts), with or without teats, and are, at one stage or another of their lives, provided with hair, though these may later be lost, or more or less obscured. Just as feathers are an indubitable mark of a bird, so hair is an invariable attribute of a mammal. In fœtal life, even the glossy-skinned whales are covered with hair, as are human beings; and the baby elephant is born with a covering of hair. The adult whale retains only a few bristle-like hairs on the upper lip.

Neither the Amphibia nor the Reptilia possess either hairs or feathers, nor glands for secreting milk for their young. Mammals alone possess sweat glands and oil glands, some being locally specialized, others generalized and scattered over the skin. Reptiles and birds have a dry skin, whereas the Batrachians (Amphibia) have a skin rich in sensitive organs and glands of all sorts. Reptiles and amphibians are cold-blooded, their body temperature changing with the external temperature. usually one or two degrees above the surroundings. Nearly all mammals (and birds) preserve a constant temperature, considerably higher than that of their usual surroundings. The body temperature of mammals is capable of varying with safety to the extent of only a few degrees.

MAMMALS DERIVED FROM REPTILES

Notwithstanding these and other numerous features in which mammals differ from amphibians and reptiles, if the theory of evolution is valid, the Mammalia must have evolved from either the Amphibia or the Reptilia.

Years ago Huxley came to the conclusion that the Mammalia were derived from the Amphibia, and this theory was widely accepted. It was believed until quite recently that certain characters in modern amphibia are primitive, and were the same in the early reptiles. This is now known to be a fallacy, thanks to the indefatigable labors of modern palaeontologists. Fossil reptiles found in the Triassic rocks of South Africa show quite clearly that the earliest mammals were derived from some generalized branch of the Reptilia, close to the cynodonts (dog-toothed reptiles). Even in the Permian (just preceding the Age of Reptiles), reptiles with mammal-like features in their skeletons had already appeared. In most reptiles the teeth in the front and back portions of the mouth are much alike. In the mammal-like reptiles of the Karoo series of strata in South Africa, the teeth are no longer uniform, but are developed into incisors, a canine or "dog-tooth," and a series of premolar and molar teeth behind. It is quite possible that some of these mammal-like reptiles were developing toward a more or less warm-blooded phase, through a change which produced the four-chambered heart and complete separation of the arterial and venous circulation.

The Monotremata are mammals that lay large reptile-like eggs with a firm leathery shell. While they lay eggs, they are nevertheless mammals, since they nurse their young, somewhat in the manner of the higher mammals, but with an important difference.

MILK FOR BABIES

When the young of these queer creatures are hatched, they are nourished by the mother from primitive abdominal milk glands, the milk percolating through a sieve-like place in the skin, buried deep in the hair. The young simply lick off the drops of milk as they drip from the hair. These primitive mammary glands are only modified sweat glands, formed in the skin. Here we meet with a good illustration of the principle that any organ found in a higher animal is invariably derived from a pre-existing organ in a lower form of life. No magic is required—only evolution.

There are two families of these egg-laying mammals, both of which agree in possessing certain marked reptilian characters. When the first specimen was exhibited in England, it was at once declared to be a fake, on a par with the manufactured or composite mermaids at that time shown everywhere. One is not surprised to hear of this skepticism. Even seeing is not necessarily believing when one stands before a "furry quadruped with the bill and feet of a duck", an animal with a coat of soft brown fur, that lays eggs, yet gives milk to its young! But such is the miscalled "duck-billed mole" of Southern Australia.

The other family, represented by Echidna and Proechidna (the latter an inhabitant of New Guinea), is known as the "Australian ant-eater," or "spiny ant-eater." The most common species has a heavy protective covering of stiff quill-like spines like a porcupine, with an underlying layer of coarse hair. It has a long snout, no teeth, and a rudimentary tail, much like that of a bird. And it lays eggs like a bird, but only one at a time. It undergoes a short incubation in a marsupial-like brood pouch. The very immature young *Echidna* lies quietly in the pouch for some time, just able to lick up the milky secretion that exudes from the walls of the pouch, saturating the hairs licked by the young ant-eater.

The aquatic duck-bill, on the other hand, has no pouch. It lays two or three eggs in a nest made of grasses, similar to a simple bird's nest, the eggs being kept warm by the body heat of the mother.

Whereas the young of the spiny ant-eater has no teeth when born, the young "Duck-bill platypus" has a set of milk teeth, *all molars.* These drop out and are replaced by broad horny plates developed from hardening of the gums which line the inside of the bill.

We have, in these survivors of the Age of Reptiles, not the ancestors of modern mammals, but highly modified descendants of a primitive type of pro-mammal, lower in the evolutionary scale than the marsupials, or pouched mammals, most of which are also peculiar, to Australia—a continent cut off from the rest of the world some time during the Age of Reptiles. Perhaps the Fundamentalists can explain to their satisfaction just how the montremes and marsupials reached Australia from Mt. Ararat, 5000 years ago!

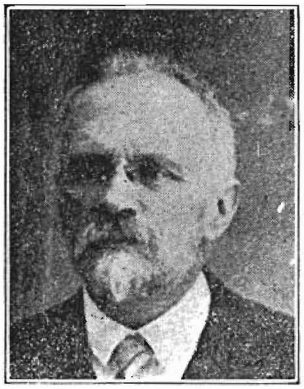
Fossil remains of very primitive mammals are found in the strata overlying those in which the cynodonts were found. The former were all small animals, the size of a rat, or smaller. Some of these early mammals were of very generalized types, capable therefore of giving rise to the varied forms met with at the beginning of the Tertiary Era, Age of Mammals.

We now meet, for the first time, with fossil forms somewhat similar to some of our modern lemurs, or half-apes. In later strata true apes appear, followed still later by the fossil remains of the higher anthropoids, or man-like apes. Finally ape-like men appear, along with crude implements of industry and the chase.

Thus we may trace our own family back to the very beginning of the Mammalia, the class to which we belong—and even to the Reptilia, our remote ancestors.

Proposal to Cross Man and Ape

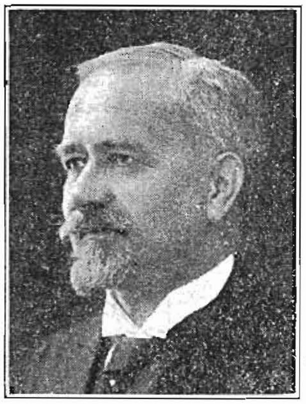
By HOWELL S. ENGLAND



ELIE IVANOFF

FOR the past eighteen years I have tried to interest some American scientist in the possibility of producing primitive man by hybridizing the several anthropoids with the different races of man. Realizing that the anthropoids could not remain in good health anywhere in the United States it was my idea that a plant for carrying on experiments should be established somewhere in Africa or the East Indies.

The only encouragement that I received from any American scientist was from Dr. Oscar Riddle, of the Carnegie School of Experimental Evolution, but this school, under the terms of its foundation, could not establish any plant for any purpose outside the United States. Within the last year I have also gained the active co-operation of Dr. A. L. Herrera of Mexico.



ALBERT CALMETTE

In September, 1924, I learned that the French Government had made a grant to the Pasteur Institute of several thousand acres of land at Kindia, in French West Africa, and had built a laboratory for experimenting with gorillas and chimpanzees by innoculating them with various human diseases for the purpose of preparing serums for their cure.

Dr. Calmette describes the climate of Kindia, the natural home of chimpanzees and gorillas, as being healthy for orang utangs and gibbons and also suitable for the residence of white scientists.

I therefore asked Dr. Calmette whether his plant at Kindia could be used for the experiments that I had in mind. He acknowledged the great importance of my proposed experiments, and said that his plant at Kindia would be open to the scientists of the world for this purpose and that he had instructed Mr. Wilbert, who is in charge of the work at Kindia, to co-operate in every way. He said, however, that before beginning the experiments it would be necessary to have a foundation of approximately 500,000 francs, roughly $100,000.00.

Dr. Calmette introduced me to Dr. Elie Ivanoff of Moscow, a biologist deeply skilled in artificial fecundation, who also had in mind the producing of primitive man by hybridizing the various anthropoids, and who was willing to go to Kindia and begin the work as soon as possible.

HOWELL S. ENGLAND

Since then I have tried, so far without success, to obtain the necessary foundation of $100,000 for Dr. Calmette. The work has now begun of raising the required amount of money by popular subscription. Mr. Freeman Hopwood of Box 483, City Hall Station, New York City, has kindly consented to act as treasurer for the fund. It is my suggestion that we name the foundation "The Edward D. Cope Foundation of Experimental Anthropology", thus making it a memorial to the late Professor Cope, whose original work in Palaeontological research did so much to establish the doctrine of biological evolution.

How Old Is the World?

By Allan Strong Broms

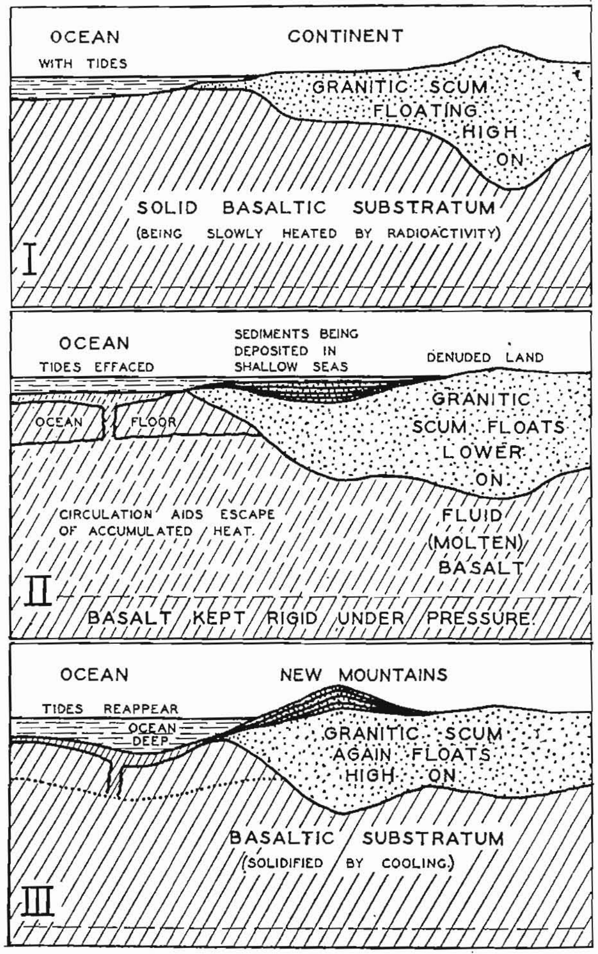
THE existence of ocean tides tells us one important thing about the earth's interior,—it is rigidly solid. Were it fluid (even a thin layer under the cool outer crust) there would be tides in that fluid and the thin crust would heave and fall upon it in time with the waters of the ocean. The crustal tides would thus efface the ocean tides. As this does not occur, we know that at present the earth's interior is rigid as a solid.

But though the interior rocks yield but slightly as tides, they are not unyielding under great pressures. Under the enormous weights of the overlying rocks, they flow slowly and thickly, yielding most where the pressure is heaviest. On this viscous interior the surface rocks *float*. Where they are heavy, they sink deep and produce the beds of the oceans. Where they are light, they float high, producing our land areas.

Heavy Substratum

We are very sure that the heavy rocks of the ocean beds and those deeply underlying the continents are largely *basaltic*. Outflows of volcanic lavas indicate this. The lighter continental rocks, which float like a scum on the heavier substratum, are largely *granitic*.

It happens that the basalts melt at a lower temperature than the granitic rocks. This means that as the interior heat of the earth accumulates (due, as we discovered in the last article, to the heat-emitting radioactive elements thorium and uranium distributed through the rocks), the basalts will eventually melt into a fluid layer under the still solid, unmelted crustal rocks.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WITH TIDES
CONTINENT
GRANITIC SCUM FLOATING HIGH ON
SOLID BASALTIC SUBSTRATUM
(BEING SLOWLY HEATED BY RADIOACTIVITY)
I
OCEAN
TIDES EFFACED
SEDIMENTS BEING DEPOSITED IN SHALLOW SEAS
DENUDED LAND
OCEAN FLOOR
GRANITIC SCUM FLOATS LOWER ON
CIRCULATION AIDS ESCAPE OF ACCUMULATED HEAT.
FLUID (MOLTEN) BASALT
II
BASALT KEPT RIGID UNDER PRESSURE
OCEAN
TIDES REAPPEAR
OCEAN DEEP
NEW MOUNTAINS
GRANITIC SCUM AGAIN FLOATS HIGH ON
BASALTIC SUBSTRATUM
(SOLIDIFIED BY COOLING)
III

As the basalts melt, they expand, with two important results. On the one hand, the expansion slightly increases the earth's diameter and circumference. To expand, the crust cracks. Into the cracks then flow the molten lavas from below. They soon cool and harden, and thus effectually prevent any later reduction of the crustal surface to fit a shrinkage of the interior.

On the other hand, the expansion of melting means a reduction in density of the basaltic substratum. This reduces its power to support the overlying continents, which thereupon sink deeper. As the continents sink, their lowlands are invaded by shallow arms of the sea. Within these transgressional seas are then deposited layers of sediments washed in by streams from the neighboring lands. Layer upon layer is laid down, adding to the weight and forcing the continental masses locally deeper into the underlying subtstratum.

A Period of Rapid Cooling

But when the substratum rocks become liquid, they flow. Twice a day they rise and fall in great tides,—and of course, the crust and oceans with them. More important, the deeper and hotter lavas rise, displaced by the cooler (and heavier) upper lavas which sink. A vertical circulation thus sets in, its effect being to carry heat rapidly towards the surface. These rising, hot lavas also attack and melt the bottom of the solid crust, particularly the basaltic ocean beds, reducing their thickness and therefore their power to keep the interior heat from escaping into outer space. The heat from radioactivity, which, according to Professor Joly, has been accumulating for perhaps thirty or forty million years, now rapidly escapes through the ocean beds in some six to twelve million years.

But the interior heat cannot thus escape through the thick, unmelted continents. It must go right on accumulating without relief, to what end we can hardly say. But fortunately, the tidal pull of the moon must cause a slow westward drift of the protuberant land masses. In due time, every part of the overheated substratum is uncovered and given its chance to cool off.

Mountain Building

As the substratum cools and hardens, it shrinks. The substratum tides disappear and the ocean tides reappear. The earth crust, enlarged to fit the expanded substratum, now wrinkles into great folds as it settles down upon the shrinking interior,—downward folds making valleys and ocean-deeps, upward folds making mountain ranges, both kinds being great, unstable, pressing arches that break and fault and crush. Ranges bearing north and south, such as those of the Americas, doubtless relieved the east and west pressures, while others bearing ea and west, notably in southern Eurasia, reduced the north and south circumference and pressures.

Also, in solidifying, the substratum becomes denser. Upon this denser support, the continental scum again floats high. As the continents rise relative to the ocean levels, the shallow, transgressional seas retire from the lowlands. The continental masses underlying these seas, hitherto forced deep into the substratum by the increasing weight of the accumulating sediments, are now slowly uplifted by the denser substratum. Just where the water-laid strata are thickest, there will be upheaved the greatest mountain ranges. So we find sea beds and their fossils on the highest of mountains. With our modern knowledge of geology, we can understand this without straining piously over any absurd flood story.

A SERIES OF GEOLOGICAL CYCLES

We have clear evidences, gathered by the patient and exacting labors of the geologists, that five or six of these great cycles have occurred in the decipherable history of the earth. We are ourselves at the beginning of a period of slow heat accumulation which must in the remote future, as in the past, culminate in another geologic revolution of crustal tides and heat escape, of transgressional seas and birth of mountain ranges. The whole story canot be told in these brief sketches, but the main events, with the related story of organic evolution, will be outlined in the next article. For the details and supporting evidence, the reader is referred to John Joly's "The Surface History of the Earth."

Proofs of Evolution from Geology and Palaeontology

By HUGH F. MUNRO

GEOLOGISTS have classified about two hundred and fifty thousand feet of rocks as comprising the known thickness of the earth's crust, although its actual thickness is much more, the lowest or Pre-Cambrian layer being of unknown extent. Heat and pressure have profoundly modified the Archaean rocks, as evidenced by their structure; and no (or at least very doubtful) indications of life are found. Such rocks as granite and basalt have undoubtedly been formed directly by the cooling of molten matter and naturally furnish no trace of organic remains. Next come the great Huronian series, a thick group of sedimentary rocks containing considerable indirect evidence of life (e.g., limestones) and some problematical fossils. Then comes a transition series, the Belt Terrane, containing undoubted through fragmentary fossils. The lowest rocks of the next series (Cambrian) form the lowest stratum of the Palaeozoic or Primary Era and here are found the first abundant traces of life. These traces are of the simpler kinds of organisms, the invertebrates, and are only found in sedimentary rocks that have been formed by the accumulated detritus derived from preexisting rocks. The duration of the Pre-Cambrian era must have been as long as all the succeeding epochs put together, and the total lapse of time since the beginning of the formation of the sedimentary or stratified rocks (including the Pre-Cambrian) would be at least 100,000,000 years.

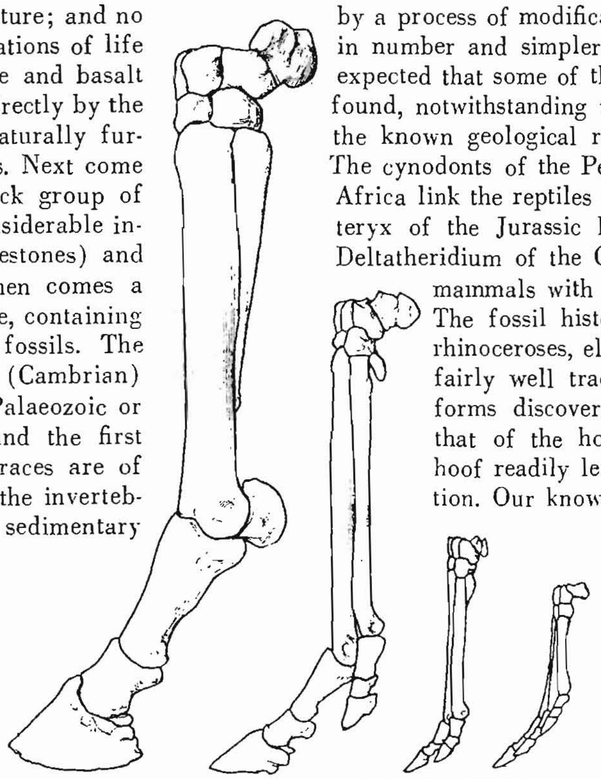

FIG. 2. EVOLUTION OF THE FORE FOOT PRINCIPAL STAGES

(Right to Left)
1. Four-toed horse *Eohippus*. Eocene Epoch
2. Early three-toed horse *Mesohippus*. Oligocene Epoch
3. Later three-toed horse *Merychippus*. Miocene Epoch
4. One-toed horse *Equus*. Pleistocene Epoch and Modern

All outside views showing the middle and outer digits of the fore foot. In *Eohippus* the two outer toes (digits IV and V) are complete. In *Mesohippus*, digit V is reduced to a small splint and digit IV is notably smaller than the middle digit. In *Merychippus*, digit V is a tiny nodule of bone and digit IV has become very slender in comparison with the middle digit. In *Equus* digit IV is reduced to a long splint, while of the fifth digit no trace remains

Ascending the geological scale, we find fishes first appearing in the Ordovician strata, then successively Amphibians in the lower Carboniferous, reptiles in the upper Carboniferous, birds in the Jurassic, mammals in the Triassic, and man in the most recent or Pleistocene formation, which is about 4,000 feet thick.

If it is true that all existing species have descended by a process of modification from other species fewer in number and simpler in structure, then it is to be expected that some of the intermediate links could be found, notwithstanding the admitted imperfections of the known geological record. And such is the case. The cynodonts of the Permian and Triassic of South Africa link the reptiles and the mammals; Archaeopteryx of the Jurassic links the reptiles and birds; Deltatheridium of the Cretaceous links the placental mammals with the more primitive mammals. The fossil histories of cephalopods, horses, rhinoceroses, elephants and camels have been fairly well traced and numerous connecting forms discovered, the most complete being that of the horse, whose peculiar one-toed hoof readily lends itself to popular explanation. Our knowledge of this extremely interesting series, largely due to the late Prof. O. C. Marsh, has been ably summarized by Dr. W. D. Matthew. The horse family originated from the Condylarthra, a group of five-toed ungulate mammals, which appears at the base of the Tertiary. The evolution of the horse took place chiefly in America. A summary history of the fore foot is shown in the illustration from the American Museum of Natural History.

(Continued in next issue)

EVOLUTION

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SCIENTIFIC "SNOBBERY"

We agree with much of the article by T. Swann Harding in this issue. The aversion of many scientific men to "popularizations" is a fact. This deprives the average man of a broad knowledge of truth, and leaves a fertile field for fundamentalism.

But it is not mere "snobbishness." The scientist must needs employ precise and specialized language in his everyday work. To write popularly he must translate. This is difficult. It takes time. And he always has more work than time.

Besides, popularizations tend to distort and sensationalize. The scientist revolts at distortions. He wants facts, unglossed and unperverted. He devotes his life to get things straight and he wants them put straight. We respect him for this. It is not snobbery. It is scientific care and honesty.

In spite of these difficulties, or rather because of them, we ask men of science to help produce this journal.

THERE'S A DIFFERENCE

A lawyer is specially trained to pick out of all the facts those that will best sustain his case.

A salesman is trained to select from all the facts those that will make the best talking points and to keep still about the others.

A minister is trained to ignore facts or harmonize them with what he considers revelation.

A politician is trained to discern what facts will have popular appeal.

A scientist is trained to consider ALL known facts, to search constantly for new facts and to hold opinion in his special field only on the basis of facts.

DEBATES—THE MORE THE BETTER

In his Official Organ the Reverend Riley crows mighty cockily over "winning" some debates against evolution. What difference does it make how the crowd votes? Has the reverend a single instance of "converting" an evolutionist?

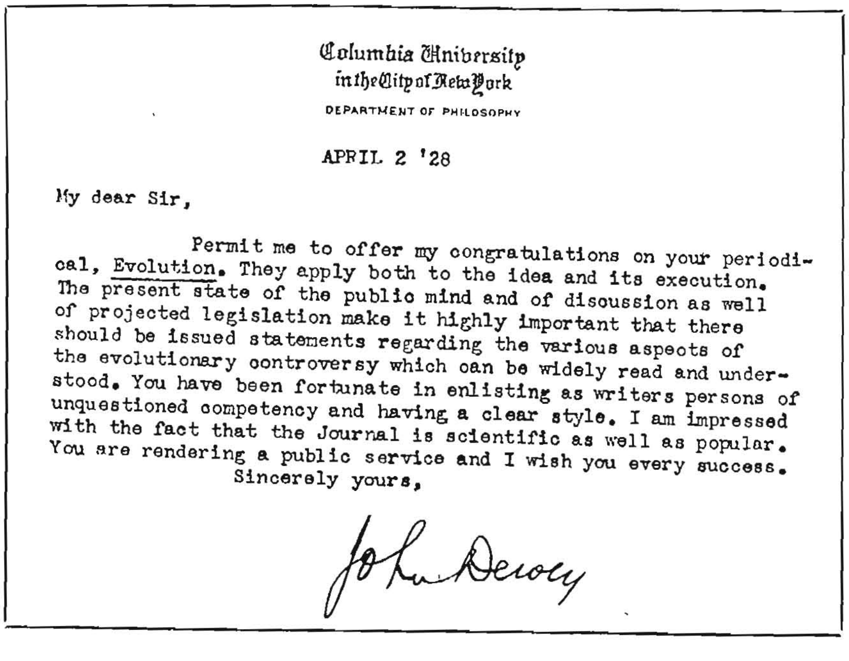
On the other hand, we are sure that on every such occasion the seed of evolution is planted in some minds. The more opponents are at the debates the greater our opportunity.

We urge readers to arrange public debates with fundamentalists on every possible occasion. The more the fundamentalists "win" the more they lose. And we can afford to lose a thousand times. WE need only win *once*.

WRITERS, WE BEG OF YOU

Send us less speculative articles on philosophy and religion, the Origin and Destiny of the Cosmos, the Whyness of the Wherefore and the Thusness of the Because.

Let's have more interesting news, facts, discoveries of science regarding the processes of nature. Less argument. More description.



Columbia University
in the City of New York
DEPARTMENT OF PHILOSOPHY

APRIL 2 '28

My dear Sir,

Permit me to offer my congratulations on your periodical, Evolution. They apply both to the idea and its execution. The present state of the public mind and of discussion as well of projected legislation make it highly important that there should be issued statements regarding the various aspects of the evolutionary controversy which can be widely read and understood. You have been fortunate in enlisting as writers persons of unquestioned competency and having a clear style. I am impressed with the fact that the Journal is scientific as well as popular. You are rendering a public service and I wish you every success.

Sincerely yours,

John Dewey

THE UNIVERSAL TRUTH OF EVOLUTION

V. F. CALVERTON

WHILE the idea of evolution was first discussed by the Greeks, and Anaximander early argued that:

"Living creatures arose from the moist element as it was evaporated by the sun. Man was like another animal, viz: a fish in the beginning. . . .

"Man was born from animals of another species . . . while other animals quickly find food for themselves, man alone requires a lengthy period of suckling. Hence, had he been originally as he is now, he would never have survived . . .

"At first human beings arose in the inside of fishes, and after having been reared like sharks and become capable of protecting themselves, they were finally cast ashore and took to land," it is rather in the form of suggestion than verification that the theory was advanced. Aristotle, in his penetrating deductions, had subjected about five hundred and forty animals to examination. He had conceived of a graded order of life, in which evolution was inherent. In many other phases of Greek thought an evolutionary attitude is to be detected.

What we wish to stress in this article, however, is that the theory of evolution, although first proposed by the Greeks, does not become a scientific hypothesis until certain material changes take place in man's life. All during the Middle Ages the theory of evolution was undeveloped. The static form of life and the ecclesiastical influence upon letters discouraged the evolutionary approach. It is only with the rise of commerce at the close of the Middle Ages that modern science actually began. It is no capricious coincidence that Kepler, Copernicus and Galileo fall within the loose embrace of this new period. These changes in physical science were closely connected with changes in economic life.

The Industrial Revolution was, however, the cause of far greater transformations in Western life. We may say without exaggeration that the outstanding characteristic of Western Europe during the nineteenth century was "*change*." The Industrial Revolution was the dynamo that electrified the age with new desires and fresh vision. Life became agog with activity and creation. Newness almost lost its novelty. New aspirations multiplied with every dawn. Invention succeeded invention until the genius of the age became a miracle in mechanics. Men became interested in the mastery of existence. The machine promised a new world at human command. Once an adventure into the strange and mysterious, science now became an open sesame to the control of the universe. The idea of movement and change became an obsession. Evolution became an active doctrine that invaded every avenue of thought.

The ancient aeons of the earth's past disclosed themselves in geological formations and structures. The rapid mutations of the modern world revealed themselves in social science and historical theory.

At this time modern geology was born and the earth was seen in an entirely new light. The rocks embedded beneath its surface disclosed the changes that had occured in its history and the presence of fossils identified these epochs. A certain ecclesiastic of note maintained that these fossils had been inserted into the soil by God in order to test men's faith. Nevertheless, geology progressed and through its evolutionary hypothesis became an important science for man.

Into the study of society and the family the idea of evolution was introduced. In political science and economics the evolutionary attitude became paramount. The same evolutionary approach is marked in the study of literature and art. In this same era arose an evolutionary conception of religion. And in psychology the whole modern outlook is a dynamic evolutionary one.

The theory of evolution advanced by Darwin is therefore only part of a vast movement which shook every field of thought with its vibrations. To oppose it is to oppose the entire advance of human intelligence in every avenue of thought. The evolution of man from more primitive forms of life is bound up closely with the idea of evolution in every other field of study. Only ignorance can today deny its truth.

BREAD AND BUTTER VALUE OF EVOLUTION

In a recent address at the New York Botanic Gardens the renowned botanist, Dr. John M. Coulter, pointed out the "bread and butter" value of a knowledge of evolution to the human race. In the last ten years the increase in the possibilities of food production has begun to outstrip the increase in population, thanks to a study of plant crops in the light of evolutionary knowledge. So perhaps Malthus was barking up the wrong tree.

EVOLUTION DINNERS

At the time of going to press we had word that EVOLUTION dinners were being arranged in Denver, Chicago, Detroit, Los Angeles and Rochester, to take place at the same hour as the EVOLUTION dinner at Cafe Boulevard, New York, 6:45 Friday evening, April 13, to celebrate our first anniversary.

Undoubtedly readers of EVOLUTION will also gather in many other cities on that evening. A complete report will appear in our next issue.

At the New York EVOLUTION dinner Charles Francis Potter will be toastmaster and Alexander Goldenweiser will open the symposium on "The Evolution of EVOLUTION." Among the other speakers will be: Leonard D. Abbott, Allan S. Broms, George Dorsey, Harry Hibschman, Joseph Lewis and Henshaw Ward. There will be music by Laura Newell-Veissi, Harpist, and Lorene Davis, Trumpet and Mellophone Soloist.

THE VERDICT OF COLLEGE PRESIDENTS

To ascertain the attitude of the college world toward the issues raised by the fundamentalists we recently sent a "Confidential Questionnaire" to every college and university president listed in the New York World Almanac. Eighty-three out of 560 answered. No replies came from the larger universities, which would, of course, be unanimous for evolution. But the answers from medium-sized institutions came from all over the country, and can be accepted as fairly representative of the college world.

(Considering only the "yes" and "no" votes, the proportions would be as shown in the diagram.)

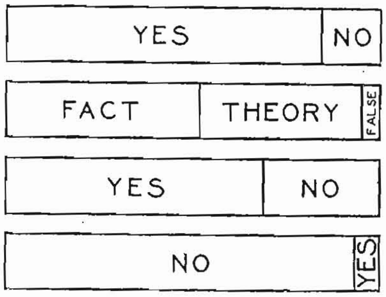
The questions and answers were:

1. "Is evolution taught in your institution?" Yes, 64; no, 11; noncommittal, 8.

2. "Is it taught as fact or as mere theory?" Fact, 41; theory, 27; false, 5; noncommittal, 10.

3. "Do YOU consider evolution a fact?" Yes, 40; no, 25; noncommittal, 18.

4. "Should teaching evolution be prohibited by law?" Yes, 5; no, 66; noncommittal, 12.



If these eighty-three colleges are divided into four sections, it is found that there is nothing sectional in their attitude toward these questions. The sixty-four colleges teaching evolution as a fact include: East, 16 out of 22; Central, 20 out of 24; West, 15 out of 19; South, 13 out of 18. On the other hand, each section has one of the college presidents that want the teaching of evolution prohibited by law except the East, which has two, both in New York State. Needless to say that these are all presidents of rather insignificant denominational colleges.

Since we agreed in this questionnaire to keep the answers confidential unless comment was written on a separate sheet, we cannot indicate the identity of the colleges participating, but our readers may rest assured that the full details would give the fundamentalists small comfort.

A few of the Honorable Presidents made delightful contortions in their efforts to avoid direct answer to the question, "Do YOU consider evolution a fact?" One counters with: "Any scientific theory is subject to revision, i. e., gravitation and relativity." A most profound observation. Another sidesteps rather awkwardly: "Our professor of biology does. I am not a scientist." And another shows his inexperience at pussyfooting by: "It depends on what you mean by evolution." He needs to take lessons from the more expert colleague, who observes very learnedly: "In my judgment, a very valuable and interesting hypothesis, worthy of careful and candid consideration with an open and inquiring mind."

And then we have a sidestepper par excellence, who comes back at us with: "You as a scientist must know, as I do, that evolution is a method and a process and not a fact." And a truly fancy pussyfooter who squelches us: "Your question indicates immaturity of thought."

One who does not hide his light under a bushel, but lets us have his comment for publication, is C. E. Erickson of Upsala College. Under the heading, "Evolution, Fact or Theory?" he writes:

"It is a rather uncritical way of stating the question. Is there a sharp line of division between fact and theory? I believe that evolution *leans* more toward the theory side than toward the fact side. What *brand* of evolution would you call a fact? Lamarckian, Darwinian. Bergsonian, Mutation? Or can we believe in evolution in general as a fact without agreeing on the details? Can we believe in *what* without knowing *how?* This we can do only when our knowledge is made up of facts of sense experience. But evolution is mainly a *logical construction,* and if the logic fails, what becomes of the theory? There is at least as much loose thinking on evolution today as there ever was in theology."

How true, professor, how true. This last about "loose thinking" we mean.

But you'll agree that there's nothing loose about the following, which comes straight from the manly shoulder of President Frazer of Queen's College:

"The institution at Queen's College has no interest whatever in your propaganda concerning evolution. We have a corps of enlightened teachers and run our institution according to our conception of truth, and do not wish to have anything whatever to do with such propaganda as you are interested in."

And there's a real wallop from J. Oliver Buswell, Jr., whose letter head proclaims "Let There Be Light and There Was Light." He tells us what's what as follows: "We have a thoroughly equipped and well organized group of scientific laboratories in Wheaton College, but we have no sympathy whatsoever with an atheistic propaganda which masks itself with the popular scientific terms of our day."

Thus the college presidents. In spite of these comments, according to the result of this questionnaire, the overwhelming majority recognize evolution as a fact and teach it as such in their institutions, and they are almost unanimously opposed to the fundamentalist efforts to prohibit the teaching of evolution by law.

The Beebe Collection

J. O. BEEBE

Two of the most enthusiastic supporters of EVOLUTION are Mr. and Mrs. J. O. Beebe of Los Angeles. Although they have been very ill this winter (he is 82 and she is 75) their names have appeared several times in our EVOLUTION Honor Roll.

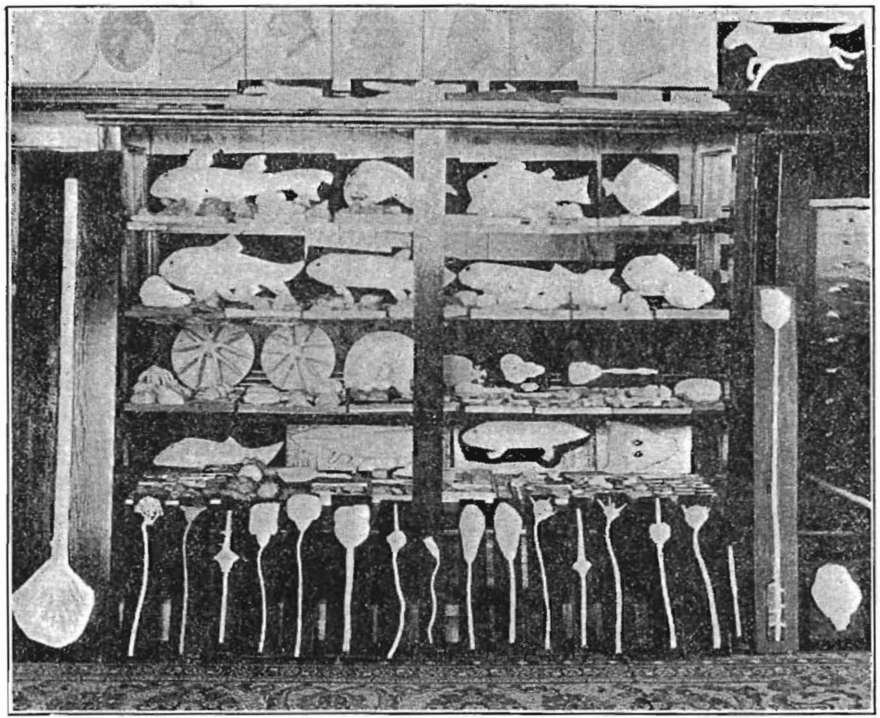
Perhaps this is but natural, since theirs is a life time interest in the subject. They have in their home one of the most complete collections of fossil crinoids, starfishes, sea urchins, trilobites, corals, insects, etc., to be found anywhere in the world. Their collection of over one hundred thousand specimens constitutes a most convincing demonstration of the FACT of evolution.

The collection of fossil crinoids (so-called stone-lilies) is particularly interesting. Crinoids are animals low in the scale of life. They have existed in the oceans through the ages for at least forty million years. They grow on roots like vegetables and are reared on stems, their bodies and arms resembling flowers or tiny bushes. Yet each has a stomach, internal organs and a nervous system. They bristle all over with proofs of evolution, plainly visible from age to age.

MRS. J. O. BEEBE

One of the strangest specimens is the Antedon Crinoid, which still lives in the ocean. This has the power of breaking itself away from the stem, turning mouth downwards and growing into the "Comatula", which starfish experts want to call a starfish.

The illustration, showing only one of the large number of cases housing the Beebe collection, gives but a faint idea of the treat in store for those who have opportunity to examine it. It bears witness to a lifetime endeavor on the part of Mr. and Mrs. J. O. Beebe, who may well be proud of having compiled this concrete proof of evolution, and it gives us great pleasure to introduce two such servants of science as an inspiring example to our readers.



Ancestral Man. Primitive horse. Primitive fishes and starfishes. Sea animals, among them the long stems of stone-lilies or crinoids (really animals).

DID LIFE BEGIN?

(From Herald-Tribune, June 10, 1927)

IN the perennial discussion of where, when or how life may have begun on earth, it seems never to occur to the disputants to make the first and most obvious of inquiries, the inquiry whether life began at all. Strict logicians would insist that the very idea of beginning is a human artifact; there is no proof of it in nature. The debate which has raged around so many country store cracker barrels as to which came first, the chicken or the egg, conceals a real uncertainty. Even without venturing into the most rarefied altitudes of philosophic thought, it is obvious that the idea of a beginning slips easily through the fingers of the mind. Every one admits that an acorn may become an oak. At what exact instant does it cease to be an acorn and begin to be a tree?

Uncertainty about just what constitutes beginning is strictly applicable to the supposed beginning of life. There has been life on earth, geologists believe, for at least a billion years. The earth itself is far older. Sometime during the unknown prehistory of a few billion years nonliving matter altered somehow into living matter. There is no biological reason to imagine that the change was sudden. Even if science possessed a perfect record of the missing millenia it would be as impossible to put a mental finger on a certain moment and say, "Here is when life began," as it is to select the definite second when an acorn begins to be a tree. Critics will urge that the acorn always possesses the potentiality of being a tree, which is quite true. And how does any one know that this is less true of matter and of life?

In the adolescence of the earth, newly cooled from the ball of flaming gas which the sun is believed to have cast off, natural conditions were not those of today. For one thing, there was probably no trace of free oxygen in the air. The chemicals dissolved in the ocean were different from those of to-day. Very slowly these dissolved chemicals came to be alive. Some celestial chemist, dipping an exploratory finger into that ancient manufactory of life at intervals of a thousand years, would have perceived no change. Only at time intervals to be measured in millions or billions of years would life be perceived some day to have crept in unnoticed. Parents, seeing their children daily, observe no change. It needs the distant uncle, arriving for his first visit after a decade, to notice that a new man or woman has begun.

WANTED:—

Every reader to be a reporter for the Funnymentals column. Send exact quotations from fundamentalist speeches and writings, suitable for publication in Funnymentals column, being *sure* to give *authority.*

The Snobbery of Science

T. Swann Harding

"It must be admitted that science has its castes," writes G. N. Lewis in "The Anatomy of Science" and he later speaks of "the snobbery of science". In the words of our modern vulgate, Lewis didn't know the half of it!

There are well meaning people who want science made available to the masses, who think that the clarity and precision that could be imparted to mass thought by a widespread acquaintance with scientific method would be invaluable socially, politically, economically and in mere personal relations. These good people simply do not realize the almost insuperable difficulties in the way of acquainting the masses with science.

Scientific popularization by the non-scientist untrained to think precisely, unused to examine evidence, to evaluate facts and form sound, impartial judgments, who has never undergone the vigorous scientific training, simply cannot write competently upon science. He finds it hard system supplant verification and reality.

What can he do? He can write a good story, speaking journalistically. By unfounded inference and unwarranted liberties he can produce an article which will hold the attention of the average reader and will for that reason merit favorable editorial consideration. The average editor does not ask whether such an article is accurate. He asks whether it will hold the attention of his readers.

He also says, "If this stuff is over my head it is probably over the heads of my readers." This is probably untrue. For readers are really more ready for dignified scientific enlightenment than editors are to give them such enlightenment. Nor is there any valid reason why an editor should fear to embark upon a moderate educational program from time to time. He could still make money and at the same time be leading his readers to a better appreciation of scientific endeavor.

But this editorial obstacle is only one thing which obstructs popular enlightenment in science, and this is very far from a castigation of editors. The scientist himself shares the blame for separating science from the public. In fact, the attitude of the editors becomes more comprehensible when we consider the snobbery of science. Let us give an example.

The Russian Government produced a cinema film of the physiologist Pavlov's work on secretions, reflexes and the localization of various brain centers controlling muscular, auditory, visual and others acts. An audience of average intelligence, scientifically untrained in complex research so remote from ordinary life, could view this film and in one hour and a quarter gain a useful comprehension of twenty-eight years work by this famous physiologist and his co-workers.

The film was a masterpiece in lay education. The audience learned more in less space of time than they had ever learned on that subject in their lives before. It told more of evolution than could be conveyed to these people by volumes, which they probably would not read anyway. Here was no propaganda, no fevered effort to convince—but mere, unvarnished facts speaking visibly for themselves —the greatest educational force in the world. A little fundamentalist flapper from Richmond, Virginia, who had never heard of biology in her life save to be warned against it, was suddenly convinced of evolution and her entire anti-scientific training was undermined fatally within the hour. Let such films multiply and we should soon have fundamentalists clamoring to give alms to research laboratories instead of clamoring for anti-evolution laws.

Then how did scientists, on the average, view the effect of this film upon laymen? Hrdlicka and other great scientists thought the show worth seeing. But as an example of snobbishness, a certain pair of young research workers who saw this film typify the attitude of many scientists. They absolutely deplored it. Such an attitude might be expected from older men, but these were representative young workers in science, products of the very finest British and American universities. They deplored the film as an example of pernicous popularization which should never be indulged. Intelligent laymen should be aware of this snobbish scientific attitude which is quite in line with a fashionable attitude in scientific circles today.

To be sure they differed in a minor degree. One thought that science should be reserved altogether for the amusement and delectation of scientists alone, and kept entirely free from the proletariat. He was obviously a high churchman. The other was a broad churchman. He thought that the masses might seek to learn of science and to find something for themselves if they always did so by individual initiative, but that no efforts should be made to interest the masses in science because that would mean a sacrifice of dignity. In either case, such an attitude bodes ill for science.

The heretical investigator who seeks to convey what he or others have done in clear and concise language is derided, deplored and declasse. That explains why the editor is really troubled with the rejection of so little effective scientific writing, for only the scientific writer can competently do that writing and so few dare do so. Yet people are so determined to adhere to the worshipful attitude towards holy, sacred scientific research that few care to acquaint readers with an aristocratic snobbery on the part of pure scientists which does more to retard the dissemination of the scientific viewpoint, and therefore the progress of civilization, than any other single factor. This snobbery should be scotched before it does science serious damage.

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A hunter without ammunition is in the same fix as an evolutionist without copies of Evolution. Surely YOU don't want to remain in such a pickle. The best way out is for you to fill in appropriate characters on the following blank in a hurry.

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Funnymentals

"Believers in Evolution are one third beast, one third devil and one third University Professor." Evangelist Dixon of Chicago, in Straton's Church.

"I thank God that we have no free schools nor printing presses, and I hope that we shall not have any for a hundred years; for learning has brought disobedience and heresy and sects into the world, and printing has divulged them and libelled governments. God keep us from both." Gov. Berkley of Virginia, quoted by Robert Baird, The Christian Retrospect and Register, 1851.

"Bring a man to believe that the decalogue is not divinely inspired and that human government has no better basis than a particular stage in an evolutionary process, and he will inevitably trample the decalogue under feet, disregard your State statutes, and end in prison." Christian Fundamentalist, April, 1928.

"The opinion of the earth's motion is of all heresies the most abominable, the most pernicious, the most scandalous; the immovability of the earth is thrice sacred. Arguments against the immortality of the soul, the existence of God and the Incarnation should be tolerated sooner than an argument to prove that the earth moves." Jesuit Father Melchior Inchofer, 1631.

"This magazine (Evolution) which sets up to fight fundamentalism is really fighting dialectic materialism and a scientific approach to the universe much harder. It takes its stand against fundamentalism, but also against scientific materialism and for theism, fideism, spiritualism and every kind of 'modern' and 'enlightened' ideological reaction, with even fundamentalism having an opportunity to sneak in again by the hack door."—Bertram D. Wolfe, New York.

"The ark was approximately 450 feet long, 75 feet wide, and had three floors. Very little food was necessary, enough simply for the maintenance of life. Many of the smaller animals and birds could occupy cells with the larger animals.—It is well to suppose that the "twos" in the ark were not systematic species, but natural species, capable of varying in descent after the flood in the same manner as the human species has done. It is, therefore, unjust to the Sacred Record to insist that the ark carried two of every variety, e. g., two fox terriers, two coyotes, two wolves, two jackals, two collies, etc., for that would be to crowd the ark unnecessarily in our understanding. It is better to say that the ark carried two animals we might call "dogs" from which after the flood all the above-mentioned varieties have come. The load of the ark, then, is considerably lightened.—Very likely, then, the ark contained two of each of these natural species, out of which, since the flood, the world has been replenished. Noah had one hundred and twenty years in which to make the proper selection, and doubtless God supplied him with the proper guidance." Byron C. Nelson in The Bible Champion, April, 1928.

"The Bible does not say that reproduction shall be *nearly* according to kind or *seemingly* according to kind. The statement is positive that it is *according to kind*, and that does not leave any room for the *changes*, however gradual or imperceptible that are necessary to support the evolutionary hypothesis."—William Jennings Bryan in "The Menace of Darwinism."

"Joshua would not have commanded the sun to stand still if it hadn't been a movin'." Rev. John Jasper, Richmond, Va.

BOB TAYLOR'S GEOGRAPHY STORY

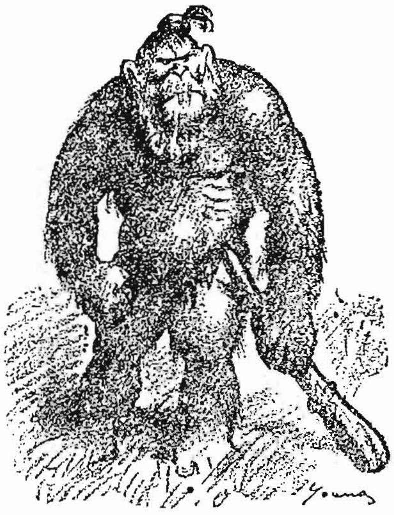
By A. Duy McNair

THE late Governor Bob Taylor of Tennessee was a famous story teller. One of the many stories with which he convulsed his audiences was that of the young man who applied for a job of teaching a country school. He was asked by the school trustee whether he taught geography by the round earth system or the flat earth system, to which question he replied diplomatically that he could teach it either way.

In certain quarters teachers of biology are asked whether they teach it by the special creation theory or the evolution theory. The public does not laugh at this as they did at the other, yet the principle is the same. They will laugh at it some day but that time has not yet come. It is assumed in the case of geography that the teacher knows his subject and should teach it accordingly, but it is assumed in the case of biology that the teacher does not know his subject and must be told what to teach or, at least, what not to teach.

The round earth theory of geography and the evolution theory stand on substantially the same footing as regards the Bible. Before the rotundity of the earth was generally accepted, the Bible was quoted to show that the earth is flat. The "waters above the firmament" and "the foundation of the earth upon the waters", the "corners of the earth", seem to imply it.

It was, of course, futile to quote these things against the idea of a round earth though the quotations were convincing to many people until Magellan's ship actually went around the earth. It is also futile to quote the Bible against the doctrine of evolution. Under the pressure of school boards and public sentiment certain teachers of biology here and there are willing to teach it "either way" but in the long run the matter will be decided by the evidence in nature.



THE HE-MAN

My father many times removed
And many times removed from that,
Went wandering through the verdant wood,
He wore no shoes nor any hat.

His wife, an equal suffragette.
He wooed and won right daintily.
He cracked her skull with his war club
And dragged her off to slavery.

So when I'm told that I am bad
And ornery and awful 'rough
I always think of my old dad
And say, "I'm not half rough enough."
G. T., in Good Morning.

FUNDAMENTALIST CONVENTION

The World's Christian Fundamentals Association will holds its tenth anniversary convention in Chicago May 13 to 20. Our next issue will contain special articles dealing with this occasion. Every reader around Chicago should supply himself with a bundle to circulate among his friends to counteract the fundamentalist campaign.

SO THAT'S HOW IT WAS

Overheard at the Los Angeles Museum School Children's Day

"Teacher, Who killed the Mastodon
That grew these monstrous bones?"
"He was crowded out of the Ark, my child
So he went to Davy Jones.

"The Big Ones couldn't get into the Ark—
They were too long and wide;
There wasn't a place on earth to park,
So they all got wet—and died;

"If God had ordered a larger craft—
With plenty of grain and hay,
And acres of deck-room fore and aft,
They would be alive today.

"But the Ark was full; it was 'S. R. O.'
With Jehovah's pets aboard—
When Father Noah slammed the door
And Jupiter Pluvius 'poured'."
J. C. Davis

ANTI-EVOLUTION BOOKS

MANY of our readers are not aware of the existence of a rapidly growing anti-evolution literature in this country. We therefore propose to review at least one book opposing evolution in every issue.

This month we intended to review "Evolution Disproved," but a review of this book made in the Buffalo Evening News of March 17 by Albert R. Shadle is so well done that we reprint it here.

EVOLUTION DISPROVED. Published by the author, *W. A. Williams, D.D.*, Camden, N. J. Revised edition, 1928. $1.00.

By ALBERT R. SHADLE

Head Biology Department, University of Buffalo.

In the introduction the author says: "Let it be understood at the outset that every proved theory of science is to be accepted." He then decries "prejudice" and narrow-mindedness and assures the reader that evolution will be examined "upon its merits and from a scientific standpoint."

His thesis is, "Mathematics the acid test," "figures will not lie"; however, it is quite evident a little later that they are manipulated in such a manner as to appear to prove whatever the author wishes to bring out. The place of the origin of man is an unsettled point scientifically, and probably will be for some time, yet the author takes for granted that the Biblical account is the only one to be considered. He then figures out the size of the Garden of Eden to have been 12,500 square miles, i. e., 100 miles wide and 125 miles long. Having these figures for the size of Eden, he figures out that Moses had one chance in 4,000 and five in making a correct guess on the place of origin of man, and the author says that Moses did guess correctly. There is no basis for these figures except that he wishes to be liberal in laying out the Garden of Eden. This is a fair sample of the manner in which figures are manipulated.

The same old trick of taking a quotation from some author and treating it in such a way as to change the whole meaning is often used. Bateson is again quoted in such a way that the reader is left with the opinion that he did not believe in evolution. Bateson did not question the fact of evolution, but was trying to reach an evaluation of the methods by which the results were accomplished.

Great emphasis is laid upon the question of the origin of new species and upon the fact that biologists do not all agree as to exactly what constitutes a species. The author then in speaking of "Geology and History" says: "Even if the missing links in the development of the horse could be found, it would still be the same all the while." This brings out the fact that he is not familiar with even the current notions of what a species is and besides that his biological information is full of errors and misstatements. There are several species of horses living today, viz, the common horse, the Asiatic wild horse, the zebras, of which there are a number of species; also different species of asses. Within the past fifty years the quaggo and one or two other species of horse have become extinct through the slaughter perpetrated by white men, either directly or indirectly. Besides these several living species, there are many others that are known only from their fossil remains, of which there is a remarkably fine series connecting four-toed ancestors, which were about the size of a dog or a fox.

In another place he says: "No transitional forms have been found between reptiles and mammals, and we have seen that there are no reliable forms between man and mammals." Thus he ignores the fact that the lowest group of mammals, the monotremes, show marked reptilian characteristics, and dismiss all palaeontological evidence of prehistoric man and of the relationship between extinct reptiles and mammals. This hardly seems in accord with the original statement of "open-mindedness and scientific treatment" of the subject, and, moreover, the statements made are not based upon facts. This sort of thing is often encountered and is due to lack of familiarity with the biological subjects which he discusses.

The author uses quotations from many sources, some of which are well taken, but many are absurd and even ridiculous. One quotation (page 46) from "In His Image" purports to be the evolutionist's idea of the origin and development of the legs of animals. The whole quotation is so fallacious that the reader marvels that educated men would resort to propaganda composed of such ignorance and willful delusions.

In regard to the fossil remains of man the author says: "As fossils must be imbedded in rock, there is not a single fossil of an ape-man in the world." This is the manner in which he tries to dispose of prehistoric human fossil remains. Judged by his own statement, he is not familiar with the general nature of fossils nor even the meaning of the term as given in the dictionary.

In spite of this very serious lack of information, he offers what are supposed to be the authoritative opinions on these matters.

In summing up the book one could say that to the biased anti-evolutionist it will be a great boon, for he will find what he wishes to read. To the evolutionist who knows the facts about evolution the book will be of interest in showing how these facts can be distorted and misstated. At times he will find it so ridiculous that it may be amusing. The reader who is looking for reliable information and an impartial presentation of the facts of the case will be very much disappointed. In places the discussion deteriorates into the rabid, ranting type of which we heard so much at the time of the Scopes trial.

SOME GOOD BOOKS

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From Our Readers

"Your editorial, 'Pussyfooting,' does not bear out the facts. It was decided that it would be better policy to avoid emphasizing the word 'evolution' and allied comment at the Nashville meeting. The fight is not so much on the doctrine or subject, fact or hypothesis of evolution as it is a fight for academic freedom. There was no reason, in the opinions of our best informed academicians, "to revive the subject." There were other matters of vast importance scheduled to take up the time of the gentlemen and gentlewomen who attended the Nashville meeting. With all due respect I believe the magazine improperly edited."—F. von Falkenberg, Florida.

"Congratulations on the splendid numbers which you have issued."—E. M. Kindle, Geological Survey, Canada.

"My Brooklyn Botanical Garden friend makes me tired when he 'regrets' that EVOLUTION proposes to use ridicule against fundamental ignorance—when Billy Sunday, Riley and others invoke hell and brimstone against scientists. Your idea of evolution is capital. Go to it while you are young."—J. M. Holzinger, Minnesota.

"I am enclosing one dollar for a year's subscription to EVOLUTION. I hope that your organization may do something toward popularizing knowledge of evolution in the South and especially at the present time in Florida, where there will soon be an exceedingly strong fundamentalist attack upon the teaching of this theory. I would like to see your periodical on the newsstands in the South. What I am most interested in is to see that it does as much good as possible and is not confined to a small clientele of readers."—S. J. Holmes, California.

"A bundle of thanks for the issue of EVOLUTION. I congratulate you and your inspiring publication. Give 'em hades. Success to your 'ole pen' and may the devil catch it where it does the most good."—W. De Coster, Minnesota.

"Your magazine is like a sharp hatchet chopping the tree of theology. It may look like a big job, but don't be alarmed; the tree is not sound under the bark."—J. De Rose, New York.

"EVOLUTION is indeed 'evoluting' in admirable fashion—growing better with each succeeding issue. I cannot refrain from 'starting the ball rolling' toward a Library Fund. Herewith is five dollars to pay for sending your big little magazine to ten public libraries for one year. Success to you in spreading the light of science throughout these benighted States."—J. M. A. Spence, Illinois.

"I showed EVOLUTION to a great churchman, who seemed properly shocked. But it faded from view about the time he left. And I had not yet read it."—Joel H. Greene, Minnesota.

"I feel happy if I can get more and more subscribers. This is the only way to educate the people."—Fr. Masek, Ill.

"We shall try and make a success of this (dinner), and possibly we can organize a group of some kind to bring a lecturer here occasionally."—Marcus De Zee, New York.

"Nevertheless, to show you I still think of EVOLUTION, I enclose check for the following (three subscribers)."—Daniel Laufer, New York.

"The (five) subscriptions are sent with the stipulation that none of these names appear in the 'Honor Roll' or in any other column of this publication without the consent of the subscribers. Sincerely yours ———."

EVOLUTION AND MORALS

By W. C. MACPHERSON

A fundamentalist quoted in your February number affirms that 'monkey men make monkey morals', amplifying this alliterative gem with other similar statements. This argument will doubtless be met often and will be offered with some apparent justification by those who believe that morality—decent conduct—is the result of standard conviction concerning punishment and reward.

Morality based upon hope or fear of consequences is a pretense,—a counterfeit,—to "get by" with the public. Those who honestly care to be decent for the sake of decency; to be respectable on principle; to be moral for humanitarian reasons will have their eyes wide open to nature's facts and much more consistently than those who cling to delusions and formulate their standards of conduct from motives of policy.

Even if the reverse were true it would in no way alter the facts of evolution. Darwin's deductions are made no more substantial, and no less so, by any opinion or observation as to what may or may not follow as a consequence of *believing* them.

Proper standards of conduct are obviously not guaranteed by religious persuasions. No more will they be endangered by a clearer general knowledge of facts underlying the world's phenomena.

Those who maintain that it were not wise to entrust the public with a knowledge of facts, acknowledge by that argument, that they are deliberately advocating what they know to be false.

PITY THE HEATHEN

If EVOLUTION reaches only convinced evolutionists it isn't worth printing. Our real task is to carry the facts about evolution to those who do not understand what it is all about, so they can no longer be stampeded by fundamentalists. This we can do only with your help. Order a few extra copies to give friends and neighbors. We'll send you five copies each month for a whole year for only **$2.50.**

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By GEORGE A. DORSEY, PH.D. LL.D.

Formerly Curator of Anthropology, Field Museum and Associate Professor of Anthropology, University of Chicago

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HONOR ROLL

The success of this EVOLUTION journal and indirectly the effectiveness of the entire campaign against fundamentalism depends upon the readers that do not merely read EVOLUTION themselves, but also ask others to read.

The following list of friends were especially active since last report. Each one has paid for the number of subscriptions indicated:

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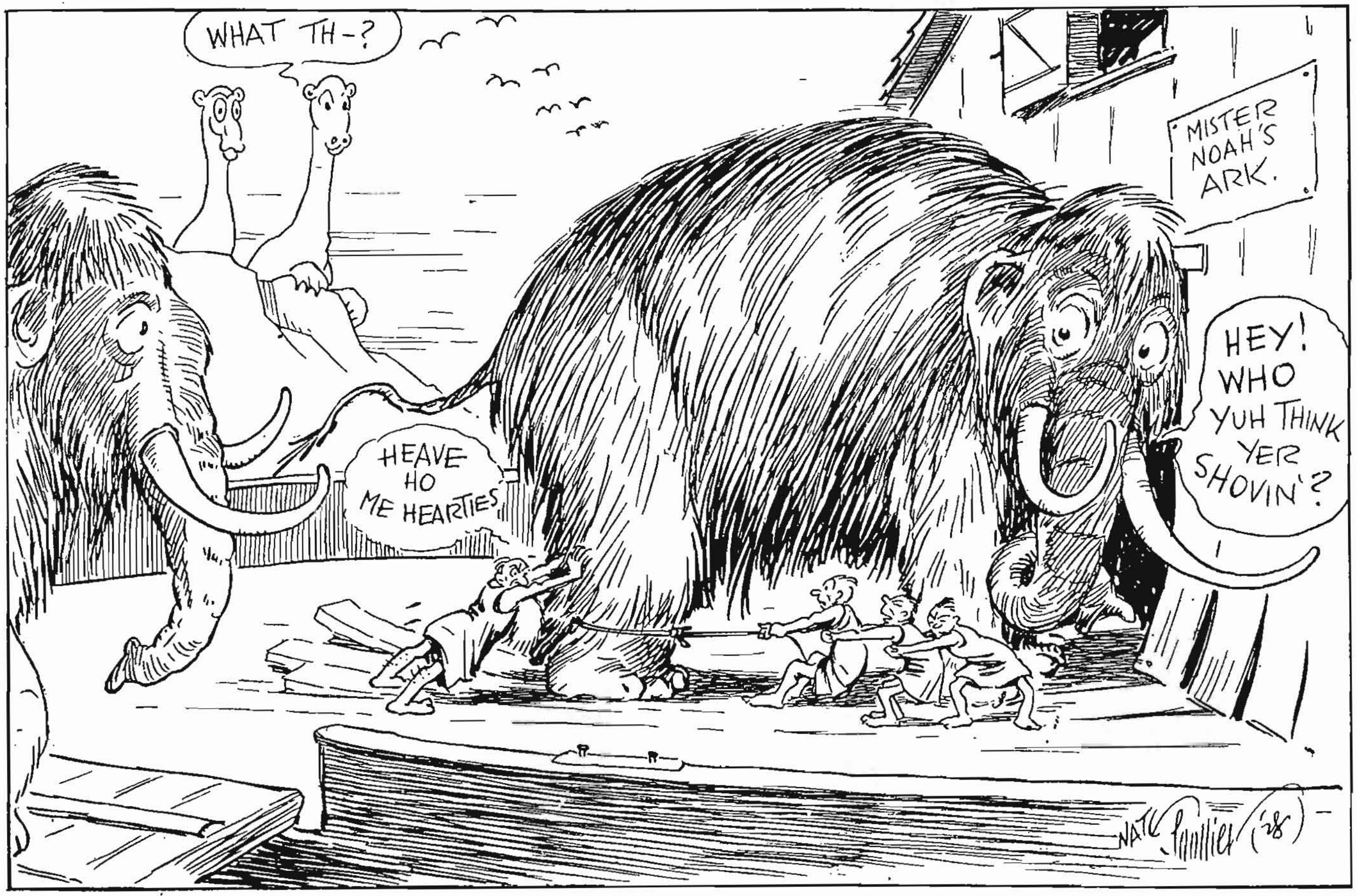
WHAT TH-?
MISTER NOAH'S ARK.
HEAVE HO ME HEARTIES
HEY! WHO YUH THINK YER SHOVIN'?
NATE Collier ('28)

"The Dinosaur and Mastodon became extinct not because of evolutionary changes, but because they were too big to be got into Noah's Ark."
Founder and President of World's Christian Fundamentals Association, in debate in Los Angeles.

THE FIRST AND FOREMOST REASON why every true friend of intellectual freedom should be a booster for EVOLUTION is not because the origin of species is a fact, but rather because the fundamentalist propaganda is in reality an adroit attempt of senile sacerdotalism to stifle freedom of thought and teaching.

THE ONLY WAY TO MEET and defeat this insidious propaganda of organized bigotry is to let the light of science shine upon the dark corners of their game.

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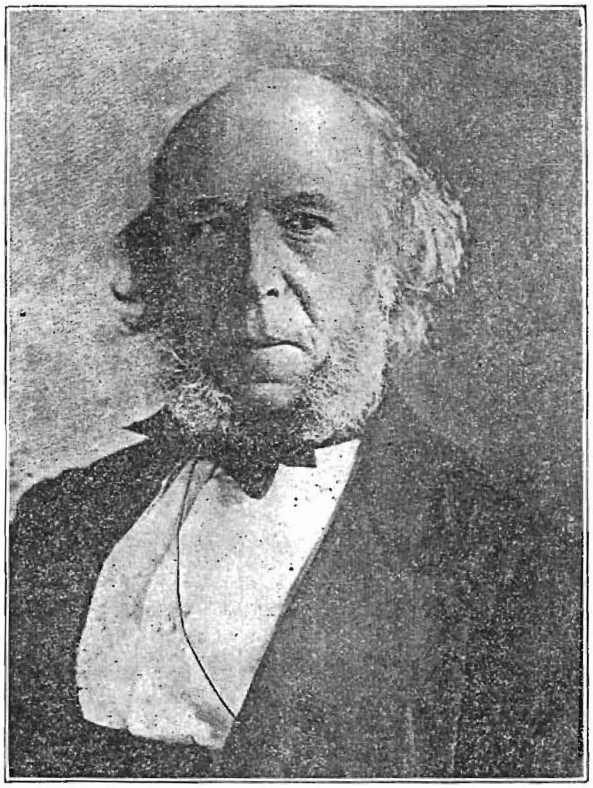
Spencer and the Synthetic Philosophy

By ALEXANDER GOLDENWEISER

IN a sense Herbert Spencer rather than Darwin should be regarded as the father of Evolution.. Under the sweep of his integrating intellect, the hypothesis of evolutionary development reached a comprehensiveness and a logical rigor which no one else either before or after Spencer was able to transcend or equal.

Brought up in a nonconformist family and possessed of an independent temperament, little Herbert, like many other eminent persons, was a bad boy. He did pretty much as he liked, studied what he chose, and neglected what he abhorred. Always he was an indifferent student, except in subjects that appealed to him.



HERBERT SPENCER

His early training, such as it was, fitted him for mathematical and mechanical work, and as a young man he spent some years as a railroad engineer. His thoughts, however, early turned to the two subjects to which the rest of his long life was to be devoted: evolution and the theory of politics or government. His article on the proper sphere of government in which Spencer laid down the principles of his political philosophy appeared as early as 1842 (when Spencer was twenty-two) and it contained all the basic thoughts later to be developed in his sociology and ethics.

Spencer was now in London, out of a job, and about to be introduced into a circle comprising some of the leading minds of the time. Having a rather delicate constitution and being a poor reader, Spencer hardly could have achieved what he did, if not for the stimulation he derived from the counsel and criticism of such figures as John Tyndall, the physicist, John Stuart Mill, Huxley, Hooker, George Eliot, and Lewis. The direct inspiration for his evolutionary theory, Spencer derived from Von Baer's work on embryology, Charles Lyell's contributions to geology, and Malthus's Essay on Population," which had inspired so many other notable achievements. Darwin influenced Spencer only indirectly, as the "Principles of Biology" had appeared before the publication of "The Origin of Species." When Darwin's book appeared, Spencer at once accepted the theory of natural selection as a striking formulation of the mechanism of biological evolution, and made it his own by incorporating it in the second edition of the "Biology."

But for Spencer, the world was a unity: evolution, if true in biology, had to apply to the entire cosmos. Thus we find that in his "First Principles," Spencer enunciated evolution as a universal process manifesting itself in the phenomena of inanimate matter, life, mind and society. This determined the scope of the synthetic philosophy which comprised the "Principles" of Biology, Psychology, Sociology, and Ethics. Unfortunately, the two volumes which were to deal with cosmology and geology remained unwritten, so that Spencer's ideas in these two domains must be gleaned from the schematic treatment in the "First Principles."

Spencer's "Biology" contains two important principles: 1. Individuation varies inversely with propagation, or the more an organism does for the race, the less is it able to do for itself; and 2. Acquired characters are inherited, meaning by this that physical or psychic traits acquired by an individual in the course of his life are transmissable to the offspring. Spencer was firmly convinced of the reality of this process and was willing to let the entire theory of evolution stand or fall on the issue. Either there was inheritance of acquired characters, he insisted, or there was no evolution. But when it came to proofs, Spencer was only able to present arguments. Of his protracted controversy with the German biologist, August Weismann, I shall tell in the next issue.

Spencer's "Sociology" in which he traces the evolution of political, ceremonial, industrial, military, and professional institutions, is notable for his sweeping utilization of the so-called comparative method which henceforth became the favorite operative tool of evolutionary writers. The essence of this method consisted in the accumulation of vast collections of data from many tribes and peoples at different times and places. These facts were then utilized to illustrate—or, as the evolutionists thought, prove the process of evolution in the history of human society. The principles the evolutionists were thus aiming to demonstrate were three: 1. civilization develops uniformly, meaning by this that it always passes through similar stages; 2. this development of civilization is gradual, meaning by this that sudden or conspicuous changes do not occur but that cultural change proceeds by slow and slight accumulation; and 3. the development of civilization is progressive, meaning by this that it tends in the direction of improvement.

It is important to remember here that whereas the general validity of biological evolution is unquestioned, the existing differences of opinion referring merely to mechanisms and processes, the theory of social evolution as formulated by Herbert Spencer and in his wake by a host of anthropologists and sociologists, has not withstood further accumulation of data and the emergence of a critical attitude. At this time, all three principles of social evolution indicated above must be regarded as obsolete or, at best, inaccurate. For social evolution is neither uniform, nor always gradual, nor is it necessarily or even generally progressive. To this phase of the subject, I shall return in the last article of this series.

The outstanding contribution of Spencer's "Ethics" comprised in the main in his "Data of Ethics," "Social Statics," and "Man Versus the State," was his negativistic theory of government. An extreme individualist, both temperamentally and in theory, Spencer resented all infraction of individual freedom. Reluctantly, he was forced to admit that the full exercise of freedom by one individual inevitably conflicts with the equal freedom of other individuals. Here Spencer felt that a super-individual agency had to step in, so as to keep the exercise of freedom on the part of each within the bounds compatible with the freedom of all. Beyond this, no government should go. This theory, aptly designated by Huxley as "administrative nihilism," immediately became the center of animated discussion, and such it has remained to this day.

As one turns to Spencer's synthetic philosophy in the perspective of time one cannot but feel that whatever the errors and exaggerations of his over-ambitious scheme, he has earned once and for all a place of honor among those who have led man's thought into natural channels. Natural facts have natural causes. If these are known, the facts are understood. If they are unknown, they must be looked for.

The Nebraska Tooth

By HENSHAW WARD

THE fundamentalists are having a merry time over the episode of "the Nebraska tooth," and we should not begrudge them their fun. The little argument will last for years and will brighten up ten thousand anti-evolution speeches. But the real lesson of this affair will never be mentioned by the enemies of science.

About six years ago there was discovered in Nebraska a tooth that looked as if it had come from the skull of some primate. It was most carefully examined by three experts of the American Museum. They all agreed that the tooth had grown in the jaw of some early ape, called "sub-human." The Bulletin of the American Museum for February, 1925, declared with absolute confidence that no tooth had ever been more rigorously scrutinized and that "every suggestion made by scientific skeptics had been weighed and found wanting." The tooth was made the basis for naming a new genus and species of anthropoid, *Hesperopithecus haroldcookii,* in honor of the finder, Harold J. Cook.

Henry Fairfield Osborn considered the tooth so important and so well authenticated that he spoke of it thus in his book, *The Earth Speaks to Bryan,* 1925: "The Earth spoke to Bryan from his own native state of Nebraska, in the message of a diminutive tooth, the herald of our knowledge of anthropoid apes in America. This tooth is like the 'still small voice.' . . . This little tooth speaks volumes of truth. . . . This bit of truth constitutes irrefutable evidence that the man-apes wandered over from Asia into North America." The newspapers accepted the judgment of the greatest paleontologists and poured upon Bryan a great deal of ridicule for denying the evidence that had been found in his own state.

But on February 19, 1928, Wm. K. Gregory, of the American Museum, gave out to the press a statement that the paleontologists had probably been mistaken. He reported that further investigations in Nebraska had shown the probability that the tooth was not anthropoid at all, but belonged to an extinct peccary, a pig-like animal. He retracted completely his former judgment of five years' standing. He announced his error, knowing full well the scorn and ridicule that he would bring upon himself from anti-science orators.

Thus a dreadful blunder was exposed. If ever Dame Science had cause to blush for the rashness of one of her followers, she had it then. John Roach Straton was inspired to real wit by this gruesome revelation; all the cohorts of fundamentalists shouted for joy, and will continue to rejoice as the years go by. They have a right to be happy.

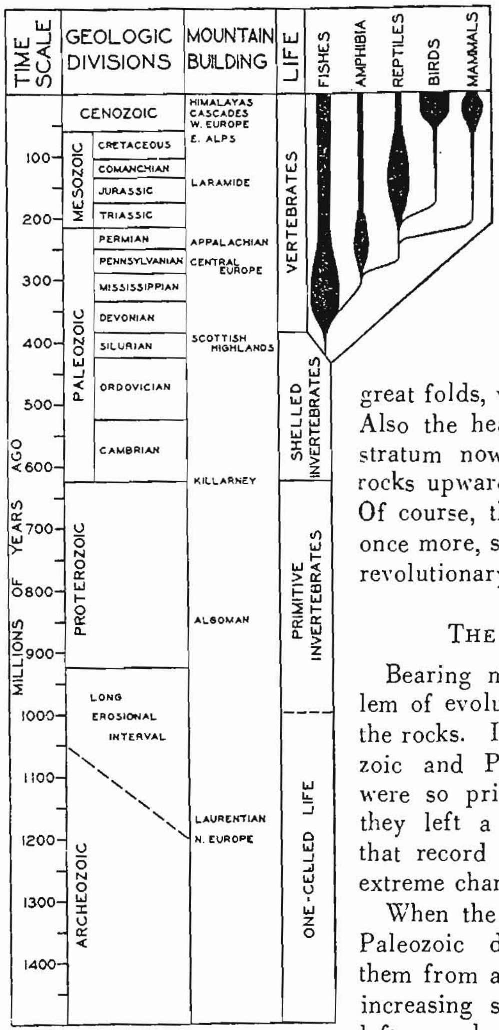
And the louder they are in mirth the more they will advertise that they do not understand what mental integrity is, nor what nobility of soul is. When Gregory proclaimed his mistake, he was doing the finest sort of act that human beings can aspire to. He was showing the world that science will not tolerate pride or hypocrisy. A scientist who palters with truth is infamous. A scientist must declare the truth as he finds it, even to his own hurt, and spare not. In all the rhetoric of fundamentalism there is not a fraction of the nobility of soul that has been shown by the episode of "the Nebraska tooth."

The strength of the evolution theory is in this very fact that at all stages of its development it has been subjected to the most severe tests, that errors by biologists have been unflinchingly proclaimed, and that the theory has thus been purged of misconceptions. The sternest critics of the theory are the men who make it.

How Old Is the World?

By ALLAN STRONG BROMS

RECENTLY published scientific measurements of the age of the earth increase rather than decrease the hundreds of millions of years since the formation of the earliest known rocks. In the accompanying diagram the consensus of conservative geological opinion is shown. The oldest known rocks are given an age of 1,500 million years, but the actual figure may be as great as four billion.



GEOLOGICAL TIME-TABLE

The most trustworthy means of determining the ages of the rocks is the uranium-lead method, already described in the February issue of EVOLUTION. We know the rate at which the radio-active mineral uranium breaks down into lead. By measuring the relative amounts of uranium and of lead in a given rock, we can fix its age very closely by a simple computation. The conservative results (tabulated by Joseph Barrell) are shown in the diagram.

The figures of the time scale are given in millions of years. Read it from the bottom up, from the earliest geologic eras upward to the present, that being the order in which the various rock strata have been laid down.

THE GEOLOGIC DIVISIONS

Five great geologic eras are shown. The Cenozoic (most recent) is relatively so short that there is no room for showing its subdivisions, which in order of time are: Eocene, Oligocene, Miocene, Pliocene, Pleistocene (Glacial Period) and Recent periods. The Mesozoic and Paleozoic eras are shown fully subdivided into periods, but the subdivisions of the earlier Proterozoic and Archeozoic eras are variously classified and are, accordingly, not shown here. Between these two earliest eras occurs a great geologic gap, during which the entire geologic record was wiped out by erosion. We know little about it other than its great, though uncertain, length.

PERIODS OF MOUNTAIN BUILDING

Without going into details, the great recorded periods of mountain building are indicated. Only the Cenozoic mountains are still high and jagged, *i. e.*, young in the geologic sense. Even such recently built ranges as the Appalachian show the signs of wear, their tops being well worn down and rounded. Many of the earliest ranges have been completely leveled by the age-long erosional forces.

It will be noted that the great periods of mountain building are spaced at fairly regular intervals. This indicates a cycle in geologic forces and accords very well with Professor Joly's theory of geologic revolutions described in the April issue of EVOLUTION, except that his estimates of the time between revolutions appear too short. But this does not argue against his theory at all. He holds that the heat from radioactivity slowly accumulates within the earth, eventually melts the substratum and the thinner crustal rocks. By expansion the substratum forces the crust as a whole outward and yet permits the mountainous areas of the crust to sink deeper into its own less dense substance. As portions of the earth crust are melted thinner, a rapid cooling, solidifying and shrinking of the substratum occurs. As the crust settles upon the shrunken interior, it wrinkles into great folds, valleys and mountain ranges. Also the heavier (because cooled) substratum now forces the lighter crustal rocks upward as great mountain ranges. Of course, the heat accumulation begins once more, slowly preparing for the next revolutionary cycle.

THE EVOLUTION OF LIFE

Bearing most closely upon the problem of evolution is the record of life in the rocks. In the first two eras (Archeozoic and Proterozoic) the life forms were so primitive and soft-bodied that they left a very doubtful record, and that record largely erased by long and extreme changes.

When the simple sea life of the early Paleozoic developed shells protecting them from attack, and perhaps from the increasing saltness of the oceans, they left a real record that would stand the wear and tear of time. From their evolutionary progression we can now classify and correlate quite definitely the several geologic periods of this and more recent eras.

By the middle of the Paleozoic, fishes, the first backboned animals, appeared. Towards its end, the amphibia (frogs, salamanders and newts being modern representatives) took the very important step from water to land and developed lungs.

The Mesozoic Era is dominated by the reptiles, which culminated in the great land and sea lizards, the dinosaurs, most amazing of our museum pieces. They were not as large as our whales, but they were built with much bulk and brawn, though with hardly any brains.

After a long preliminary development, the birds and mammals (both warm-blooded and brainy) rose rapidly to their present world mastery during the Cenozoic era. Man is one of the mammals (hair-covered and milk-nursed) and can trace his ancestry quite clearly over the few hundred thousands of years of his evolution. His span of existence on this earth has been most brief as earth history goes, being represented by less than the thickness of the top line of the diagram. But in this short time he has won rulership over the world and that solely by his wits. That is a record of which even a fundamentalist should see fit to be proud. Whether we are proud of it or not, that is the record, and it does hold the promise that, as he has done great things in the past, man shall do greater in the future.

It Is Up To Man

By GEORGE A. DORSEY

THE Smith-family-Robinson are ashore for a picnic on an island never before trod by Man. All go in for a swim. A tidal wave picks them up and drops them far inland, leaving no trace of boat, ship, or anything but the scant whatever they had on. The shock robs them of all memory of past life. They do not even remember their own names.

Once Man was like that. Nature had made him, but Man himself had not made anything. All that he has made since is culture.

Man made culture because culture seemed the easiest way to satisfy a force within. This force was the joy of life, the love to live. It drove him to get on, to try to make life more secure, to rise above and become less dependent upon physical surroundings; to postpone, to cheat, death.

He improved his lot. One thing led to another. Meanwhile he talked the situation over with his mate, parents, children, friends. One word led to another—a new word for each new tool, for every new situation. He invented a language—many languages.

Customs became established into rules for living together, rules for family life, rules to govern the group. He invented Heads of houses, Chiefs of tribes, Priests of religion—for he early took to religion.

He so loved life and had so little confidence in his own power that he sought power everywhere—in stones, in rivers, in trees, from the Serpent, from the Eagle, from Sun, Moon, and Stars. He peopled his world with ghosts—propitiated those he feared, cajoled those he hated. Anything to get more power—power over foes, over dangers, over forces, over life, over death.

He would cheat death. He would make life more secure, more stable. The quest for life led him a merry chase. It leads us a merry chase. It might be so much merrier.

Man must eat, drink, and be married—or he dies and leaves no mourners. It almost looks like a vicious circle. In a way it is—in this way: we always get back to the nature of the beast, to human nature, to the nature of life. Nature does not "believe" in civilization, vote the Republican ticket, or set kings on or off thrones. Nature is interested in food and sleep, legs and livers, and babies. Nor does she care what or when we eat—only that we get enough of certain foods; nor with whom we mate—only that we propagate our kind.

Life is simple. It is Man that is complex—complex in the vast and intricate machinery he has devised to satisfy Life's simple demands. Wonderful machinery—but are we always certain we know what it is all about, what it does to us, whether we fit into it, whether it fits us?

This machinery is Man-made, "artificial"—it has a history. Man is a product of Nature, "natural"—Man has a history. The two histories are not the same. One is millions of years long, the other but a few weeks as time flies. One begins where the other leaves off. One is Nature, the other is culture. Culture takes a thousand forms and goes by many names. Its forms change and often have but little relation to the work they were asked to do. The work to be done is always the same: satisfy Man's love of life and need for love. Culture is handed down to us from loving hands—it is our patrimony. Often we do not see it, we just accept it with child-like faith, assuming that it is what we want, what we need, all that we can get. We lean on it to get us food and sleep and rest and immortality. We count on it for support, as our ancestors counted on the spirits they propitiated with food and wine. We even throw a halo over it, venerate it, sanctify it. Or, we try to improve it, not knowing what we try to improve, not realizing that Man is of more value than custom or law.

Culture is the means to the ends of life. The ends are rooted in our natural inheritance. The understanding of that inheritance is the key to human culture; without that key we cannot unlock the chests of our social patrimony, nor separate the gold from the base metal of our lives.

ATOMS IN EVOLUTION

At the April meeting of the American Chemical Society in Washington, the assembled scientists saw photographs of atoms in process of reconstruction taken by Professor William D. Harkins of the University of Chicago and heard Dr. R. A. Millikan describe the creation of common elements through the action of his newly discovered "cosmic rays". The pictures showed "the synthesis of an atom, since a helium atom is striking a nitrogen atom and forms a heavier oxygen atom and a higher hydrogen atom." "Whether all this atom building and changing indicates a universe that is building all the time or is being steadily destroyed, as the older school of philosophy had it, is still in doubt. It builds in some places and tears down in others; it may remain in status quo."

Why Amoeba Behaves

By CLEVELAND SYLVESTER SIMKINS

THOSE minute organisms that live on the border line of naked vision as independent cells have within their structure a reaction system which at first blush seems purposeful, but which is seen to be controlled entirely by the known laws of biochemistry when examined more closely in the light of present advanced knowledge.

It was natural enough that early students of these simple life forms should have imputed to them a sort of intelligence similar to that of man, a sort of primitive soul, and insisted that they are controlled by sensations of pleasure and pain such as determine human behavior.

The amoeba is a naked bit of protoplasm. Protoplasm is complex in chemical make-up, varies in physical consistency from instant to instant, and possesses various substances whose specific gravity differs in different parts of the same cell. The surface of the protoplasm is a jelly-like membrane, while the inner material is more of a liquid. Yet this inner material may take on the same character as the surface membrane; it may become jelly-like under appropriate conditions. Within the cell the jelly and fluid states alternate. Neither is constant.

When any part of the interior protoplasm jells it shrinks, thereby producing pressure and heat, tending to convert the jelly into fluid again. These two reversible processes, known as gelation and solation, are self-regulative and unstably balanced as long as the animal remains alive. A little shove one way or the other upsets the balance, and solation goes on until it checks itself and gelation begins.

IS THIS BEHAVING?

The outer surface of the amoeba will not mix with water. Thus there exists an interface between the animal's body and the medium in which it lives. This is controlled by surface tension, not only on the outer surface but also inside the protoplasmic mass, since surface tension develops wherever media of different densities come in contact with each other. Hence, the interior of the cell is subjected to interfacial forces that are changed by every activity,—digestion, absorption, assimilation.

Both jelly and fluid are made up of molecules that have their own interfacial forces and surface films, which when distorted or influenced by any disturbance whatever, start a series of changes that effect a reaction in the organism as a whole. Any change in one part of the system will make itself felt in the more remote parts. Thus the very process of life and the succession of events supplies its own stimulus to behavior.

The series of cause and effect leads unmistakably into a reaction which the organism can not escape. It is forced to react by the very nature of its chemical and physical constitution. For example, if ultra-violet light is thrown upon one side of an amoeba, the protoplasm on that side is jelled, shrinkage occurs, the internal fields of force are distorted, the increased pressure induces solation on the other side, the softening substance flows outward and the remainder of the organism flows after it, thus moving away from the stimulus.

The forces underlying these changes reside in the surface films of the colloidal particles, the stimulus of the radiation disrupts them. This in turn disrupts the balance of the interfacial forces of so large an area that a shifting of positions, substances and forces takes place to attain a new stability. The various phases of form and motion are caused by changes in the surface tension. They constantly vary as affected by environment.

SHE LEARNS LITTLE

The length of time any given phase endures depends on the intensity of the stimulus which threw the colloids into that phase. A very strong reaction caused by actual contact with some noxious chemical will throw the surface into a jelly state that persists for some time. During this time everything encountered by the amoeba, even food particles, will be rejected. If, on the other hand, the previous experience of the organism has caused a fluid or receptive phase in the surface jell the formerly rejected particles will now be engulfed. This behavior has been cited as proof that the organism exercises a power of discrimination between two particles and chooses one or the other.

But these reactions of the amoeba to its environment do not indicate choice on the basis of pleasure or pain, nor of a primitive intelligence that chooses between two particles as an incipient sense of taste, any more than a drop of water placed upon a particle of glass and salt would choose the salt in preference to the glass. When we consider the behavior of amoeba in the light of modern colloidal chemistry, the ability to select becomes less significant as a criterion of living things. Selection does depend upon the previous experience of the organism. A series of reactions that set up a certain phase endures for a time, during which the attitude of the organism toward all things is the same, regardless of their food value. This phase soon changes, due to the instability of the protoplasm. This duration of a certain phase may be the germ of retention, which by repetition becomes established as a basic property of protoplasm and serves as the commencement of that higher, psychic process known as memory.

LACKS WILL POWER

The ability to react upon the experience of the past is a fleeting one at its highest development. In man it endures for varying lengths of time, in amoeba it endures but a moment. There is no scientific evidence available that puts us under the least obligation to explain the behavior of the amoeba as manifestations of taste, will, choice or skill, nor should we think of it as capable of forming habits. Its reactions are forced movements, determined by the intensity, character and continuation of the stimuli to which it is subject at the moment. Any so-called selective ability in the amoeba cannot fairly be called "microscopic mentality" or psychic ability", nor can isolated instances in its activity, like capturing prey, be considered as purposeful or designed, since the fundamental stimulus to activity results from an attempt to regain a disrupted balance.

BEHAVES BECAUSE SHE MUST

If the behavior of amoeba depends upon the mechanism of its elemental substance and the mechanical arrangement of its forces, where lies the evidence for a psychic state? When we assume a "psychic state" in the amoeba, we are merely projecting our own mental experiences into it. The fact that amoeba performs all the physiological acts of the higher forms leads one to believe, *a priori*, that some sort of volition influences its reactions, but when the physio-chemical structure of its body is kept in mind, no element of the entire reaction system presents factors that lie beyond the reach of objective science, unless it be in the vastly more complicated and delicately adjusted balance that obtains in a living colloidal suspension. It is true that all the adjustments of the living cell are too subtle to have yet been observed by the human eye. However, the ability of the human brain to analyze the structure of all things that live increases at an uncanny rate. So we may look forward to the time when we can write the chemical formula that expresses the phenomenon of life.

The only psychic state which the amoeba has may be said to be the duration of the effect of a given stimulus, a holding over into the future of an effect of the past, a capacity which tends to become fixed through repetition, which develops with a neuromotor system, is bequeathed to progeny, evolves, comes to reside as nascent memory in special nervous organs and culminates in the baffling mental life of man.

Man's Fossil History

By HUGH F. MUNRO

BONE for bone, and organ for organ, man is one of the higher mammals.

His body is made up of the same number of systems (osseous, muscular, digestive, nervous, etc.) as is that of the animal and is arranged in the same manner and performs the same functions. Like the animal, his individual history begins in a single cell. He is nourished, grows, reproduces and dies as do the animals. Within their limited scope in the animal, he is assailed by the same diseases and is cured by the same remedies. He is fatigued by exertion, as they are, and he requires periodical rest as they do; in fact, every one of his vital processes has its exact counterpart in any one of the higher mammals. It is, however, one thing to say that he in general represents the animals, but it is quite another to prove that he is related to them by descent. It is now generally agreed that his immediate progenitor is not to be found in any of the existing anthropoid forms, but that he and they have developed from an ancestor common to them both, and his comparatively late advent in geological time would lead us to expect that here again intermediate forms could be found; and they have been so found.

In Asia the most primitive body of the human line or the most human like body of the ape line is represented by the fossil remains of the ape-man Pithecanthropus Erectus found by Dubois in 1891, in an early Pleistocene deposit at Trinil, Java. As was to be expected, the cranial capacity of this fossil shows a stage more advanced than that of the ape, but less than that of man. The volume of the brain cavity (between 850 and 950 cc.) indicates a brain of about 28 ounces in weight; the forehead was more receding than in the modern chimpanzee. As the maximum brain capacity of the gorilla is only about 20 ounces (in volume between 500 and 600 cc.) and the average human brain weighs about 49 ounces (1450 to 1550 cc.) and the smallest normal brain of living man is probably never less than 30 ounces, it is clear that the brain capacity of Pithecanthropus is more than halfway between that of the ape and of man.

The most conservative estimate of the lapse of time since the Pithecanthropus places it at about half a million years ago. The next oldest human remains were found in 1907 in some river deposits at Mauer, near Heidelberg, in Baden. The specimen comprises only the lower jaw with all of its teeth, yet it displays a combination of characters not found in any other specimen, living or fossil. There is no chin prominence and the shape of the whole jaw is more like that of a large ape, yet the teeth are distinctly human. It was found associated with a large number of fossils of animals now extinct, which enables the life date to be placed at the second inter-glacial period or 350,000 years ago. Other fossil remains possessing more or less clearly defined animal and human characteristics are the Neanderthal, the Piltdown, and about half a dozen unnamed specimens discovered in various parts of the world. In semi-desert Bechuanaland, South Africa, Prof. Raymond A. Dart, of the Witwatersand University, has discovered an almost perfect fossil skull of a type intermediate between the living anthropoid apes and man. The new fossil has been named Australopithecus Africanus, but it will probably be known as the Faungo skull, from the name of the community near where it was found. Geologists place the life date of this skull as some time during the middle part of the Tertiary period, probably in the late Miocene or the early Pliocene epoch. This period, on a conservative estimate, is from two to three million years ago, making it the most primitive human fossil so far discovered. The *Scientific American* of May, 1925, gives a very complete and illustrated description of this fossil, and comments as follows on the discovery: "Thus is another part of the gap between man and his simian ancestor filled in by an additional 'missing link.' Thus is Darwin's prediction that the direct ancestor of man when found would prove to be some form of forest-dwelling ape tied up tighter with tangible evidence. Thus does the theory of evolution as applied to man receive another and a weighty vindication."

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A PERNICIOUS PRACTICE

To curry favor with fundamentalist text book commissions certain publishers print special editions of their school books, leaving out any mention of evolution.

We can respect the fundamentalists. Many of them act according to their lights. They simply don't know any better. They at least believe that they are acting in the best interests of the growing generation, that they are safeguarding their children from what they consider dangerous doctrine, when they advocate and enforce anti-evolution laws.

But we can not respect publishers that deliberately put out misleading texts for the sake of "business", nor pussy-footing authors that are willing to cash in on these deplorable prejudices by lending their names to books that feed the growing mind on mere husks instead of the solid grain of truth.

EVOLUTION is investigating this entire situation, and expects to make a report in an early issue that will jar the smug complacency of those guilty of this pernicious practice. We invite our readers to co-operate by bringing to our attention any specific instances of which they may be aware.

THREE MARTYRS TO SCIENCE

In quick succession, three eminent scientists of the Rockefeller Institute have given their lives in defence of humanity against the dread tropic disease, yellow fever. They are Professor Adrian Stokes of London University, the Japanese Doctor Hideyo Noguchi and Doctor William Alexander Young who all died of the disease they were fighting. Working at Accra, on the African Gold Coast, they had already isolated the germ of the disease and were on the verge of success in their search for a cure. Records they have left of their discoveries and progress will permit the completion of the work of these heroes of science who gladly made the supreme sacrifice that mankind might be freed from another great scourge.

IT'S IN THE POINT OF VIEW

The Professor said to the protoplasm:
"Truly, there is a mighty chasm
Between the two of us, my friend,
You the beginning, I the end."

The protoplasm made reply,
Winking his non-existent eye,
"Since I've been watching you, old man,
I'm rather sorry I began."

Author Unknown

EVOLUTION FOR FARM ANIMALS

In the March issue of EVOLUTION, we reprinted an abstract of the work done by Dr. H. J. Muller of the University of Texas in speeding up variation in fruit flies by exposing them to X-rays. Now comes the announcement from Leo J. Brosemer of Chicago, nationally known authority on scientific stock breeding and formerly junior animal husbandryman in the U. S. Department of Agriculture, that, with the help of other scientists, he is beginning a series of experiments on the application of the same method to the large, slow breeding animals of the farm. Sensational things are looked for when the rays are applied to cattle, pigs, poultry, wheat and other farm subjects and he hopes to do as much in three or four years as breeders have heretofore been able to do in a century.

IN ENLIGHTENED NEW ENGLAND

The press reports that in Manchester, N. H., the Board of Education bars books mentioning evolution, for the reason that "as long as we have to omit the teaching of religion in the schools, there is no reason why we should open the door to this scientific theory."

TEACHERS IN TROUBLE

Teachers who have difficulties because of teaching about evolution are invited to communicate the facts to this journal.

HOW TO WORD A WILL

One of our friends writes: "I do not intend to die soon, but in case of accident I should have a will made favoring EVOLUTION. Can you tell me the right way to proceed?"

Simply incorporate in your will the following: "I give, devise and bequeath .... dollars to the Evolution Publishing Corporation, a corporation organized and existing under the laws of the State of New York, or its successors."

NOTICE TO SUBSCRIBERS

Since EVOLUTION did not appear for May and June, all subscriptions will be extended two months. The year will include twelve numbers.

IF YOU CHANGE YOUR ADDRESS

for the summer, be sure to notify us, giving your old as well as the new address. And, of course, try to send us a few new subscribers at the same time.

ANOTHER CHANCE FOR CRUSADERS

By JOSEPH McCABE

It is just about three centuries since one of the most gifted of Englishmen, Lord Francis Bacon, turned aside from his more ponderous work to pen a little utopian sketch called "The New Atlantis."

Bacon's Utopia is unlike any of the others. The general character of the others was that they cut down the hours of labor yet miraculously increased the production of wealth. They always forgot to tell the secret of the increased production. Bacon, with magnificent foresight, saw that science was going to prove this source of enrichment. His main idea that each State should have a wonderful central College of Science, the various national colleges communicating freely with each other, and wealth and progress would be ensured.

Science was extremely rudimentary in his day, thanks to the philosophers and theologians who uplift us with their spiritual realities, yet Bacon's genius dimly described the glorious promise of the future in the rudimentary principles. Writers who try to belittle Francis Bacon point out how vague his language was. Naturally. Let them try to tell what the chemist or the electrician will be doing three centuries from now. The fact is that, with a necessary haziness, Bacon foresaw the vast cold storage of modern times, the vehicles that would run along without horses, or would rise into the air or travel below the surface of the sea, and so on.

People smiled, of course. Fantastic idea, this, that you should look for the higher welfare of the community to a bunch of men who gazed at the stars through "optic tubes", or "nosed around the stinks of a laboratory" (as the Catholic G. K. Chesterton elegantly puts it) when there were so many brilliant statesmen, able merchant-adventurers and eloquent preachers to take care of it. Literary men and artists turned up their fine-cut nostrils and worked out neat little epigrams about science. Spiritual writers assured the world that only neglect of the higher and more precious things of life would ensue from this materialistic trust in science.

So the world had to wait two more centuries for the partial redemption that we have witnessed in modern times. Men of science meantime worked on in silence and under general disdain until the world found that they could invent machines to do the work of a hundred horses and find the power to run them. But when these men of science went on to announce the truth of evolution all the old bitterness was revived. That is a familiar story. It would sound like an episode of the New Stone Age if there were not Rip van Winkles amongst us who have just awakened.

The other day I conducted a Catholic lady around Westminster Abbey, the greatest of the old churches of England, the incarnation of its religious spirit. I maneuvered her quietly to a certain corner of the wonderful and beautiful Valhalla of the English nation, and then, as she gazed around, told her to read the brass lettering which told on whose grave she was standing. Charles Darwin!

The day will come when men will raise one of the most superb monuments in the British national mausoleum to Darwin, and pilgrims from all parts of the world will seek that obscure tomb, over which the echoes of psalms and hymns still roll daily. Darwin not only opened a new age for science: he opened up a new and splendid vista for men.

* * *

Everything that is, Evolution says, will pass away. It is, as a rule, a stage to higher things. "Everything flows" was the two-word summary of the teaching of a certain Greek philosopher two thousand years ago. There are many things that we want to see flowing into the oblivion of the Middle Ages. But nature is slow: or, rather, it has reached the stage when its finest agencies are the thoughts and sentiments of man. Flowing is not now good enough. We want something more rapid. A large and vigorous minority in any civilization could sweep away all these dark old reactionary forces in a few years. Timid compromise with them is useless. They have assured me that they despise it. This will probably be the last chance of crusaders for the merry work of fighting dragons.

A CLERICAL JUGGLER

By EDWIN TENNEY BREWSTER

NOTHING more amazes the simple layman, in all this Anti-Evolution fracas, than the fashion in which the clergy juggle their verbal formulas quite regardless of the obvious facts of nature. Byron C. Nelson, D. D., for example (*Bible Champion*, Dec., 1927, p. 640) regards it as "the strongest reason for rejecting evolution" that:

"Mendelism teaches that the various forms, *i.e.*, shapes, colors, and other physical characteristics of living organisms are produced by the presence in species of certain things called 'factors.' (Of course, Mendelism does nothing of the sort.) These factors descend in the germ plasm from generation to generation, and, as far as is known, they cannot be destroyed without the destruction of the offspring, neither can they be altered."

Or in other words, according to the Reverend Byron C. Nelson, D. D., there can never be an albino. Normal men have a "factor" for skin pigment. If that is "destroyed," that is the end of that creature. Neither can there be a white kitten or a white rose. You think you see them, but you don't! Moreover Burbank's spineless cactus was just another scientific fraud; and alleged "hornless" breeds of cattle really have invisible horns. For the "factor" for spines or horns cannot drop out "without the destruction of the offspring." Moreover, since "factors" cannot be altered, there are really no Baldwin apples, no Concord grapes, no golden bantam sweet-corn, no pink roses, no long-haired or tailless cats, no six-fingered men, nor any of the thousand-and-one "mutants" that we laymen deceive ourselves into thinking that we see!

Truly, theology is a wonderful science!

"Not merely what we do, but what we try to do and why, interprets what we are." A. Nielen.

"Ideals are like stars. You will not succeed in touching them with your hands, but like the sea-faring man on the desert of waters, you choose them as your guides, and following them, you reach your destiny." Carl Schurz.

Anti-Evolution Law Proposed In Arkansas

IN Arkansas the fundamentalists are trying out a new tactic this year in their war upon the teaching of evolution. They will submit the question to popular vote at the next election. The provisions of the initiative and referendum law furnish them the opportunity to do this. If eight per cent of the voters sign a petition requesting it, any proposition has to be printed on the ballot and submitted for decision to all the voters at the next regular election. So the fundamentalists have got the brilliant idea of appealing directly to the people, and settling this question of science by popular majority vote.

Already two months ago they boasted that they had over 20,000 signatures to their petition, nearly twice the number required by law, but they have not yet filed it. A. L. Rotenberry, one of the sponsors of the bill, frankly admits that he is waiting until July to file the bill so that the campaign may be shortened and the evolutionists have less time for their educational campaign.

The full text of the petition sponsored by the Arkansas Anti-Evolution League and the American Anti-Evolution Association, is as follows:

INITIATIVE PETITION

To the Honorable Jim B. Higgins,
Secretary of the State of Arkansas:

We, the undersigned legal voters of the State of Arkansas, respectfully propose the following law, to-wit:

Act No...

FOR AN ACT TO BE ENTITLED "AN ACT TO PROHIBIT IN ANY UNIVERSITY, NORMAL, PUBLIC SCHOOL, COLLEGE OR OTHER EDUCATIONAL INSTITUTION IN THE STATE OF ARKANSAS THAT IS SUPPORTED IN WHOLE OR IN PART, FROM PUBLIC FUNDS, THE TEACHING THAT MAN DESCENDED OR ASCENDED FROM LOWER ORDER OF ANIMALS AND PROVIDING A PENALTY FOR VIOLATION THEREOF."

Be It Enacted by the People of the State of Arkansas.

Section 1. That it shall be unlawful for any teacher or other instructor in any University, College, Normal, Public School, or other institution of the State, which is supported in whole or in part from public funds derived by State or local taxation to teach the Theory or Doctrine that mankind ascended or descended from a lower order of animals and also it shall be unlawful for any teacher, textbook commission, or other authority exercising the power to select textbooks for above mentioned educational institutions to adopt or use in any such Institution a textbook that teaches the doctrine or theory that mankind descended or ascended from a lower order of animals.

Section 2. Be it further enacted, that any teacher or other instructor or textbook commissioner who is found guilty of violation of this Act by teaching the theory or doctrine mentioned in Section 1 hereof, or by using, or adopting any such textbooks in any such educational institution shall be guilty of a misdemeanor and upon conviction shall be fined not exceeding five hundred dollars ($500.00); and upon conviction shall vacate the position thus held in any educational institutions of the character above mentioned or any commission of which he may be a member.

Section 3. This Act shall be in full force and effect from and after its adoption by vote of the people of the State of Arkansas.

Section 4. That all laws and parts of laws in conflict herewith be, and the same are, hereby repealed.

And by this, our petition, order that the same be submitted to the people of said State, to the end that the same may be adopted, enacted, or rejected by the vote of the legal voters of said State at the regular general election to be held in said State on the 6th day of November, 1928, and each of us for himself says:

"I have personally signed this petition; I am a legal voter of the State of Arkansas, and my residence, postoffice address, and voting precint are correctly written after my name."

The Present War Against Evolution

(Part of a radio talk given over KFRC, San Francisco, on March 29)

By MAYNARD SHIPLEY

SINCE they have met defeat in a number of State legislatures the enemies of science have determined "to carry the question of evolution to the plain people." In other words, since they can not get educated men and women to approve their activities, they are going to appeal directly to the mass of the electorate, which, engrossed in other duties, has had little opportunity to judge questions of science. Their first experiment of this kind is being carried on in Arkansas.

Here Representative A. L. Rotenberry, backed by a Fundamentalist evangelist named Ben Bogart, has prepared a very stringent measure, which if passed, will even cripple the medical schools of the State and make it difficult to teach geology and biology even in the State University. This bill is being presented to the voters of Arkansas to be voted upon at the November election.

NEW ATTACKS PLANNED

If the fundamentalists succeed in Arkansas they will approach every one of the twenty States which have the initiative and referendum system in the same manner. Specifically named as the next points of attack are North Dakota, Colorado and Montana.

But this does not mean that the fundamentalist anti-evolutionists are now going to confine their attention to initiative measures. Far from it! They have eloquent, if not learned, speakers at the present moment spreading misconceptions of scientific findings and ridicule of science in Kansas and Oklahoma, which they announce will be the first states to face anti-evolution legislation in 1929. Not one of these states—Colorado, Montana, North Dakota, Kansas and Oklahoma—is in the South, where the agitation against the teaching of evolution began. The anti-scientists are spreading their net also over the north and west. Indeed, last year anti-evolution bills were introduced in two New England States—Maine and New Hampshire—to say nothing of the bill which we managed to defeat in California.

While Bryan was alive only one or two such bills were introduced in any one year, and only in the south. Now, three years after his death, under the leadership of such men as Straton and Riley, anti-evolution measures are introduced in the north and west, and in 1927 thirteen of them! They are the entering wedge, and we shall see strange sights in 1929.

MORE FUNDAMENTALIST TRICKS

Meanwhile, the general non-legislative war on the teaching of evolutionary science goes merrily on. Tennessee and Mississippi have state laws forbidding the teaching of evolution. In Texas the State Text Book Commission simply deleted from authorized text-books those passages which taught or even implied evolution, and nationally known school book publishers are now getting out so-called "Texas editions". This system has been extended to Louisiana and Florida by consent of public school officials who are "more interested in the next election than in the next generation."

In Florida, at this very moment a self-appointed committee of Fundamentalist Baptist deacons headed by a Fundamentalist Presbyterian elder is engaged in what they call "purging" the libraries of the State University and the State College for Women of books of which they do not approve. The chief objection as voiced by Elder Tatum is that they contain evolutionary teachings.

Moreover not a week passes that I do not receive a letter from some teacher complaining that he or she has been dismissed for teaching evolution and even, in many cases, for believing in it. One was from a history teacher in the enlightened state of Michigan, who was repeatedly asked specifically if he accepted the theory of evolution!

And yet there is not a living biologist or geologist of standing today who is not an evolutionist. As the late President Woodrow Wilson put it, when questioned during the Scopes trial: "I, like every other man of education and culture, naturally accept the theory of evolution."

THE BASIC ISSUE

The conflict is between two opposing cultures, two irreconcilable views of the world and of life. It can not end in a "peace without victory", but must continue until one prevails. There is the method of science, and there is the method of tradition, and every serious-minded man and woman must choose between them.

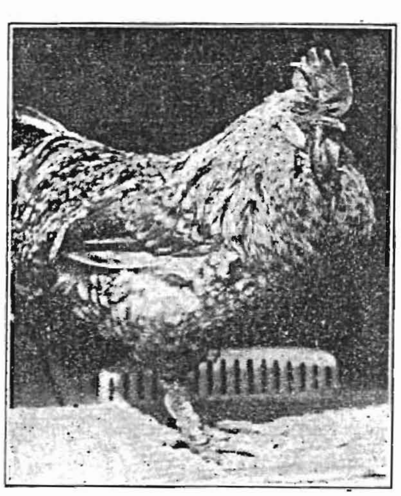
The method of science is that of observation of facts, of testing, weighing, measuring, comparing, analyzing, synthesizing. The method of tradition is that of hearsay, of handed down ideas, of so-called revelation from an alleged supernatural source. That is the method of the darkest era of man's history, when men trembled at thunderstorms and earthquakes; when there was a witch or a demon in every accident, and the only way to avert an epidemic or the evil influence of a comet in the skies was to burn candles or chant hymns or to burn the witch or torture the wizard to death.

That, it should be plain even to the most prejudiced, is not the way of the twentieth century. Today when an epidemic occurs we study its causes and cures, we work to prevent its repetition. In a thousand laboratories patient toilers are at work saying "why did this happen and how can we make certain that it will not happen again?" That is the way the Panama Canal was built—by sanitation, the destruction of the mosquitoes that caused the fatal malaria which had made engineering impossible. In the sixth or seventh century the malaria would have been approached by exorcism and prayer; and the Canal could not have been built. The monumental work that has removed the menace of yellow fever and bubonic plague from America; that increases the output of our fields a hundred fold; that lights our houses by electricity and provides the very radio over which the obscurantist mouths his ancient errors and the aeroplane by which he flies to spread his old mythologies;—all this is due to the patient investigation, the laborious toil, the strict logical reasoning of the modern scientists. And among these scientists you will not find one who has any standing among his fellows who does not accept evolution as a matter of course.

To paraphrase the striking words of Professor W. D. Mathew, of the University of California, evolution is no more a theory to the man who has studied present day science than the city of San Francisco is a theory to the man who lives in it. It is an established and incontrovertible fact.

LET KNOWLEDGE JUDGE

Some portions of some of our narrower religious sects desire to cast this fact aside and substitute for it the guesses and imaginings of people who lived long before the present era of enlightenment. Incapable of understanding the discoveries of science, they have set themselves up as arbiters of what they can not comprehend, and as better judges of delicate questions of science than the men and



Courtesy of Stephen C. Preston

A NEW STYLE IN ROOSTERS

Here's photo of a Plymouth Rock Rooster with a pair of horns atop his head. He's on exhibition at a gasoline filling station in Oregon City, Oregon. Seems hale and hearty, and gleefully grows a new horn when one of them breaks off in the wire netting of his cage.

It will be interesting to note whether this rooster becomes the ancestor of a new race of Horned Chickens. At any rate, he should be of interest to scientists investigating the knotty problems connected with the sudden emergence of entirely new characteristics.

women who have given their lives to its study.

When we want a bridge built, we go to a bridge builder; when we are planning a home, we go to an architect; when our teeth ache, we go to a dentist; when we have legal difficulties, we go to a lawyer. Similarly, when we are confronted by questions of science, we should go to the workers in and teachers of science, and not to those who know nothing of it.

If you believe that questions of science should be settled by experts in science, we need your co-operation in this increasingly urgent struggle. A note to the Science League of America, 504 Gillette Building, San Francisco—our national headquarters—will bring you an informative leaflet and an application blank.

LISTEN IN ON WEVD JULY TENTH

From 9:35 to 10 o'clock Tuesday evening, July 10th, Dr. Alexander Goldenweiser will broadcast through station WEVD, New York, on the subject: "What the Fundamentalists Are Doing."

Readers of EVOLUTION, who have been following Doctor Goldenweiser's articles in this journal, will, of course, invite their friends to "listen in."

The Evolution Issue

By A. DUY MCNAIR

There has been much controversy over the subject of evolution for several years during which time two states have passed laws against the teaching of evolution in state supported schools. In many other states the laws met defeat but a new phase of the subject opens with the referendum which will be held on the subject in Arkansas in the elections of November next. If, in that election, the anti-evolutionists win it will give a great impetus to the movement in other states but if it should fail it is likely to put a quietus on the whole movement. In either case the public will learn much that is new to them. It is an educational opportunity that should be grasped by those who are interested in what is true in regard to this subject. The writer believes in the doctrine of evolution and thinks that its acceptance will mean much in furthering the progress of men. He puts, herewith, in parallel columns what he considers the attitudes of evolutionists and anti-evolutionists on the general subject.

* * *

THE EVOLUTIONISTS	THE ANTI-EVOLUTIONISTS
Do not ask for a law requiring the teaching of evolution.	Ask for a law to prevent the teaching of evolution.
Are willing to leave the matter to the intelligence and good sense of teachers, school principals, college presidents, etc.	Are not willing to leave it to the intelligence and good sense of these people.
Believe that this matter is not a proper subject for legislative action — that it should be left to the judgment of those who are well posted on the subject.	Believe that it is a proper subject for legislation — that legislatures or referendums must protect the schools from their natural leaders.
Believe in freedom of speech, freedom of research and freedom of teaching even though it modifies preconceived opinions.	Are not in favor of freedom of teaching when it treads on the toes of their preconceived opinions on theology.
Do not tell researchers in advance what conclusions they must come to.	Tell researchers in advance that their conclusions must agree with theology.
Believe that all plants and animals have descended from one or a few forms of life by reason of variations that occur century after century. They believe that plant and animal life are not rigid but are modifiable to almost any extent provided enough time is given.	Believe that each "species" was created separately in the beginning and that any modification cannot pass the limits of the species. They believe that varieties occur within the species but cannot transcend the species.
Affirm that any law that prevents teachers from teaching what they actually believe encourages insincerity and hypocrisy and thus hurts both teacher and pupils.	Do not seem to recognize the encouragement of insincerity that would result from such a law nor the tendency to make a mere "rubber stamp" of the teacher.
Believe that all questions of biology, geology, astronomy and other sciences should be decided on the basis of evidence irrespective of theological bias.	Believe that their theological standards should be the standards of secular teaching in the sciences.
Believe that an anti-evolution law would be an entering wedge toward the union of Church and State.	Deny that an anti-evolution law tends toward a union of Church and State.
Affirm that the differences between races of men such as the white races, Chinese, Negro, etc., have required hundreds of thousands of years and possibly a million years to develop.	Affirm that the differences between races of men have developed in 5000 years or thereabouts since the time of Noah. They really believe, therefore, in fast evolution but they do not know it.
Have developed new species artificially which breed true to new characteristics.	Deny that new species have been developed.

BECOME A SHARE-HOLDER

The EVOLUTION PUBLISHING CORPORATION, organized under New York State laws, offers its $10.00 shares of 6% preferred stock. With every five shares of preferred one $10.00 share of common, voting stock will be given.

The immediate business is publishing this journal, EVOLUTION and selling books. Later a Lyceum Bureau for touring natural science lecturers will be developed.

Although it is expected the business will pay, share-holders are not invited on the basis of making profits, but because this work is WORTH DOING.

Additional capital furnished now will help make the circulation campaign for EVOLUTION magazine a success. Checks should be made payable to EVOLUTION PUBLISHING CORPORATION. In remitting kindly state whether payment is made in full, or whether it should be applied on a larger block of stock to be held until balance is paid.

LET US MAIL SAMPLES TO YOUR FRIENDS

Of course you'll show this issue of EVOLUTION to your friends and ask them to subscribe. But you probably know some who would be interested, whom you can not visit yourself. Send us their names and addresses and we'll mail them sample copies.

It will cost us about five cents a copy to send out these samples, so if you can send along a check to help pay for them we'll not object. However, if your bank account is minus don't let that stop you. Send us the names anyway and we'll raise the cash otherwise.

WHAT'S A HUNTER WITHOUT AMMUNITION?

A hunter without ammunition is in the same fix as an evolutionist without copies of EVOLUTION. Surely YOU don't want to remain in such a pickle. The best way out is for you to fill in appropriate characters on the following blank in a hurry.

— — — — — — — — —

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CREATION BY EVOLUTION: Edited by Frances
Mason, The Macmillan Co.
New York, 1928. $5.00.

An excellent book, this, with a misleading title, for what is meant is not that Evolution was the method of procedure chosen by the creator—and the title suggests this meaning — but that the process of evolution is creative.

The list of contributors is unusually impressive. President Osborn of the American Museum of Natural History, to whom we owe a most suggestive demonstration (facts at hand) of the evolution of the horse, opens the procession. He is followed by Sir Charles Sherrington, the eminent physiologist, who contributes an introduction. David Starr Jordan, late president of Leland Stanford, than whom no one knows more about the evolution of fishes, writes about the general meaning of evolution. "Why we must be evolutionists" is explained by that tireless popularizer, J. Arthur Thomson. Herbert S. Jennings, eminent protozoologist of Johns Hopkins, has some fascinating tales to tell about evolution as it can actually be seen in the laboratory. Evidences of evolution are approached from many angles: as gleaned from vestigial organs (Parker), as shown by the development of the individual organism (MacBride), as demonstrated in embryology (Conklin), as written in the record of rocks (Bather), as suggested by the geographical distribution of animals (Scott), as told by fossil plants (Berry).

In an unusually clear exposition John W. Gregory of the University of Glasgow explains what a species really is.

There is a general article on the evolution of life (Woodward, one on the evolution of plants (Jaeger), one each on the evolution of butterflies and moths (Poulton), of bees (Shipley), of ants (Wheeler), of the horse (Loomis), of birds (Watson).

The missing link is not forgotten, and its significance is commented upon by Richard S. Lull of Yale.

Professor Wm. K. Gregory of Columbia discourses on "The Lineage of Man", a subject he has made his own.

Apes deserve a place of honor in such a treatise and it is accorded them by their friend and explorer, Professor Holmes of the University of California.

G. Elliot Smith, whose ethnological vagaries have of late almost obliterated the recognition of his eminence as an anatomist, writes of the evolution of the brain.

Progress as exhibited by evolution is discussed by Julian Huxley, the versatile grandson of a great grandfather. The evolution of mind is shown by the veteran bio-psychologist, C. Lloyd Morgan. H. H. Newman, finally, of the University of Chicago, sums up the case for evolution. And a good case it is, none the less so for the honest admission by most of the contributors that here as elsewhere the widening disk of knowledge reveals the mistifying darkness around the periphery. This is as it should be, for if we knew it all, the luring light of inquiry would be blown out forever.

Alexander Goldenweiser

Evolution

By LANGDON SMITH

When you were a tadpole and I was a fish,
In the Paleozoic time,
And side by side on the ebbing tide
We sprawled through the ooze and slime,
Or skittered with many a caudal flip
Through the depths of the Cambrian fen,
My heart was rife with the joy of life,
For I loved you even then.

Mindless we lived, and mindless we loved,
And mindless at last we died,
And deep in a rift of Carodoc drift
We slumbered side by side.
The world turned on in the lathe of time,
And hot lands heaved amain,
Till we caught our breath from the womb of death
And crept into life again.

We were Amphibians, scaled and tailed,
And drab as a dead man's hand:
We coiled at ease neath the dripping trees,
Or trailed through the mud and sand,
Croaking and blind, with our three-clawed hand,
Writing a language dumb,
With never a spark in the empty dark
To hint at a life to come.

Yet happy we lived and happy we loved.
And happy we died once more;
Our forms were rolled in the clinging mud
Of a Neocomian shore.
The eons came and the eons fled,
And the sleep that wrapped us fast
Was riven away in a newer day.
And the night of death was past.

Then light and soft through the jungle trees
We swung our airy flights,
Or breathed in the balms of the fronded palms
In the hush of the moonless nights.
And, oh, what beautiful years were these,
When our hearts clung each to each,
When life was filled, and our senses thrilled
In the first faint dawn of speech.

Thus life by life and love by love,
We passed through the cycles strange.
And breath by breath, and death by death,
We followed the chain of change,
Till there came a time in the law of life
When over the nursing sod
The shadows broke and the soul awoke
In a strange dim dream of God.

I was thewed like an Auroch bull,
And tusked like a great cave-bear;
And you, my sweet, from head to feet,
Were gowned in glorious hair.
Deep in the gloom of a fireless cave,
When the night fell o'er the plain.
And the moon hung red o'er the river bed,
We mumbled the bones of the slain.

I flaked a flint to a cutting edge,
And shaped it with brutish craft;
I broke a shank from the woodland dank
And fitted it, head and haft,
Then I hid me close to the reedy tarn,
Where the Mammoth came to drink—
Through brawn and bone I drove the stone
And slew him on the brink.

Loud I howled through the moonlit wastes,
Loud answered our kith and kin;
From west and east to the crimson feast
The clan came trooping in.
O'er joint and gristle and padded hoof,
They fought and clawed and tore,
And cheek by jowl, with many a growl,
They talked the marvel o'er.

I carved the fight on a reindeer bone,
With rude and hairy hand;
I pictured his fall on the cavern wall
That men might understand.
For we lived by blood and the right of might,
Ere human laws were drawn,
And the age of sin did not begin
Till our brutish tusks were gone.

And that was a million years ago
In a time that no man knows;
Yet here tonight in the mellow light,
We sit at Delmonico's,
Your eyes are deep as the Devon Springs,
Your hair is as dark as jet;
Your years are few, your life is new,
Your soul untried, and yet—

Our trail is on the Kimmeridge clay,
And the scarp of the Purbeck flags;
We have left our bones on the Bagshop stones,
And deep in the Coraline crags,
Our love is old, our lives are old,
And death shall come amain.
Should it come today, what man may say
We shall not live again?

Nature wrought our souls from the Tremadoc beds
And furnished them with wings to fly;
She sowed our spawn in the world's dim dawn,
And I know it shall not die;
Though cities have sprung above the graves
Where the crook-boned men made war,
And ox-wain creaks o'er the buried caves
Where the mummied mammoths are.

Then as we linger at luncheon here,
O'er many a dainty dish,
Let us drink to the time when you
Were a tadpole and I was a fish.

(*This Poem, in leaflet form, 4 pages, to fit small envelope, sent postpaid at* $1.00 *per* 100; $5.00 *per* 1000. *Order from EVOLUTION, 96 Fifth Avenue, New York City*)

THE ORIGIN OF SPECIES. By Charles Darwin, E. P. Dutton & Co., New York,

Nearly seventy years after its first publication *The Origin of Species* still bears reviewing, for in no sense is it just a book of the past. Sir Arthur Keith has written such a splendid introduction to this reprint of the sixth (Darwin's last) edition and has so well stated its past influence and present standing, that I choose merely to quote.

"Its preparation occupied, from first to last, a period of forty years . . . The book came into being during a period when Europe was in a state of intense intellectual activity, and the effect it produced was immediate and profound. The generation which felt its first shock is dying or dead. . . . Having served its day and generation is it now dead? Or does it possess, within itself, the seeds of eternal youth and is it thus destined to become one of the world's perpetual possessions? The latter. I am convinced, is its destiny. On the foundations laid by Darwin in this book his successors have erected a huge superstructure which will be infinitely extended and modified as time goes on. Yet I feel certain that as long as men and women desire to know something of the world into which they have been born, they will return, generation after generation. to drink the waters of evolutionary truth at the fountain-head. . . .

"It was much more than a mere demonstration of the action of natural selection, it was the first complete demonstration that the law of evolution holds true for every form of living thing. It was this book which first convinced the world of thoughtful men and women that the law of evolution is true. . . . Nor has it finished its appointed mission. No book has yet appeared that can replace it; *The Origin of Species* is still the book which contains the most complete demonstration that the law of evolution is true. . . .

"Suppose, for a moment that an omniscient biologist, greatly daring, were to re-edit this classic—would he find much that needed alteration? Scarcely a single fact would have to be withdrawn; so accurate was Darwin in making his own observations and so careful was he in the selection of his authorities, that the modern reader may accept all his statements of fact without question. But what of his "mode" or method of evolution? The machinery involved—is it out of date? My deliberate opinion is that the machinery of evolution described in this book is not out of date and never wil be. . . .

"Far be it from me to say that *The Origin of Species* is an easy book to read. . . . What is the reason of this difficulty? It is not the style; this is simple and clear; it is not the terms used; Darwin never employs a technical word when a plain one is possible; it is not due to abstract thinking; Darwin clings always to the tangible or visible. The real explanation is its condensation; so much is packed into every sentence and every paragraph that the reader's mind becomes satiated unless he proceeds slowly and keeps his understanding busy. . . . Few men have taken out of this book all that is in it." A. S. B.

"THE DOGMA OF EVOLUTION" by L. T. More, Princeton University Press,

Professor More is Dean of the Graduate School of Cincinnati, and a physicist of standing. It might seem that such an author would not belong among the obscurantists; but his general spirit, places him with O'Toole and Price. He grudgingly accepts a general belief in evolution. but he states that "evolution of man from the lower animals . . . is purely a matter of guess." He also attacks the validity of the method and scientific spirit of Darwin and other evolutionists and biologists (Lamarck excepted).

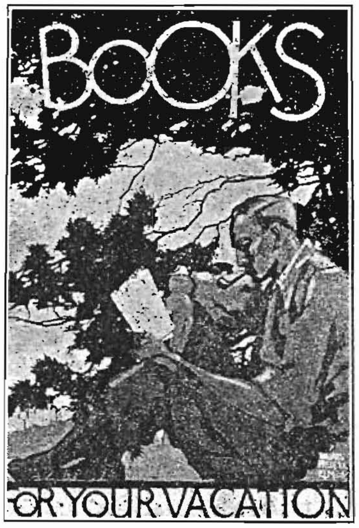
Dr. More seems completely ignorant of any advances in the fields of biology and geology during the present century. Particularly astounding is his complete innocence in regard to genetics, his calling the inoffensive unicellular amoeba "an aggregate of cells," his discovery that the first word in the scientific name of an organism represents the order, his ignorance as to the source of food of plants, and his ignorance (or misrepresentation) of the evidence from fossils.

Darwin and Huxley, the two outstanding examples of scientific integrity, he accuses by implication of intellectual dishonesty. This would come with better grace if Dr. More did not himself mislead by mangled quotations from (among others) Darwin and Huxley.

Quotations illustrating Dr. More's inadequacies could be multiplied to almost any extent. "And it is quite safe to say that today in spite of an immensely increased collection of fossils, the positive evidence of geology, considering the vastness and intricacy of the problem of evolution, is as incomplete as it was in the time of Darwin and Huxley." It is quite safe to say that this statement, if it means anything at all (observe the weasel words), is directly contrary to fact. "In the popular mind 'the missing link' has become identified with the hope of finding the bones of some wretched, filthy being which could not be called a monkey and which no one would be willing to call a man. It is, perhaps, an odd fact that the ancestors of animals are presented to us by evolutionists as other animals well fitted to thrive in their environment and adapted to enjoy life; only in the case of man, do we get the picture of inefficiency, half man, half monkey, which is indecent and degraded." Without further comment this passage is sufficient evidence of his emotional bias, loose reasoning and lack of acquaintance with his subject.

Dean More is a special pleader, trying to prove a faith rather than uncover the truth, assuming to write with competency in a field in which his equipment is scanty and antiquated.

HORACE ELMER WOOD. II.



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"The giving up of witchcraft is in effect the giving up of the Bible." John Wesley, quoted by Andrew D. White.

"Is there any one so senseless as to believe that there are men whose footsteps are higher than their heads? . . . that the crops and trees grow downward? . . . that the rains and snow and hail fall upward toward the earth? . . . I am at a loss what to say of those who, when they have once erred, steadily persevere in their folly and defend one vain thing by another." St. Gregory Nazianzen, (referring to people on the other hemisphere).

"I've been grossly misquoted. I never did say that there was an edge to the world. There's a high wall around it, as a matter of fact, a wall thousands of feet high, beyond which the good Lord has never seen fit to cast light and sunshine. It's highly possible that the dirigible Italia has slipped over that wall. If it has, it will never come back, you may be sure of that. Byrd had better look out. If he goes over that wall, we'll never see him again either." Wilbur Glen Voliva, High Priest of Zion City, quoted by Herald Tribune.

"I am in accord with the theory (of evolution) if it means the development and growth of man under God, but not if it means he sprang from the dust by pure atomic accident and is now just an ape running around in underwear." Rev. Dr. Ambrose Bailey, First Baptist Church, Seattle.

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From Our Readers

"The first eleven pages of the April number are dignified and instructive; the first column of page twelve unnecessary, and the last column merely silly. Why seek to antagonize the very people we are trying so hard to enlighten concerning the most important thing in the world, what we are and where we came from? . . . Franklin Smith, N. J.

"Your April issue is fine. You know, some people can't be reached except by ridicule—some by thoughtful writing. What a laugh we had over the Mastodon and the Ark!" E. H. Collins, Washington.

"Is it not possible to use simpler language in dealing with scientific subjects? It seems to me that any obscure subject could be discussed in plain language. . . After a day's battle in industry, I have not the time and energy to spend hours with a dictionary in looking up jaw-breakers. What about the millions of other people in this country that are in the same boat? Scientists are closing the doors of knowledge to these people by writing in terms that they cannot understand. When writing about a giant lizard let the author say 'giant lizard' and not Ceratosaurus." Irwin H. Cady, Mich.

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It will require a fund of $5.000.00 for circulation campaigns to put EVOLUTION on a self-sustaining basis, according to results already achieved. However, this is not all needed at once. Five hundred a month will do the trick. And since no "angel" or special interest backs this paper we appeal to those that approve its work for the necessary funds. Full value in shares, subscriptions or copies of the paper will be given for every dollar received.

We herewith express our appreciation to the following, whose contributions made it possible to publish this issue and mail out several thousand copies to prospective subscribers.

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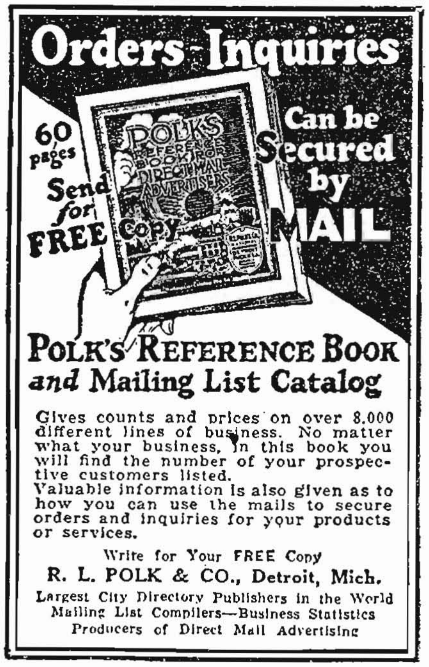
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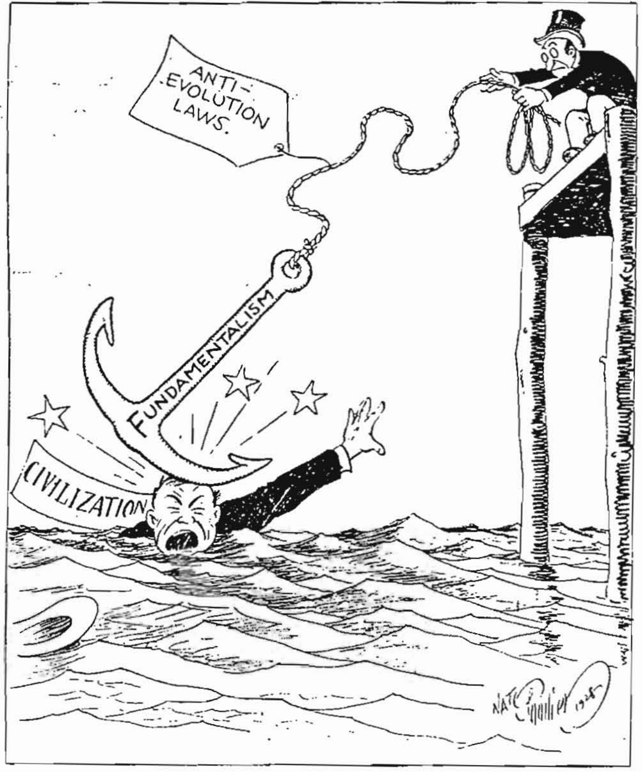

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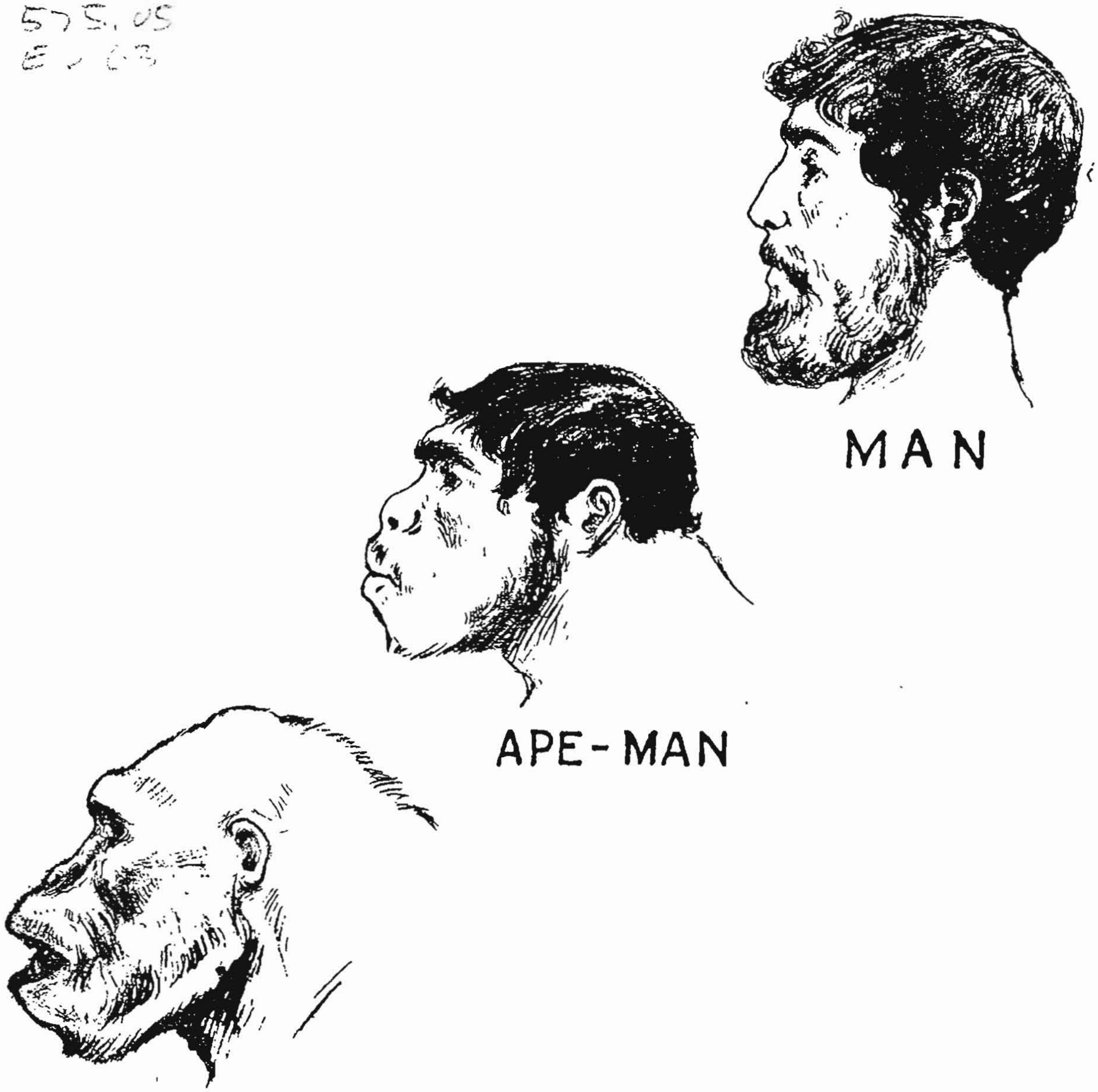


Courtesy of
American Museum of Natural History

ARKANSAS BATTLE BEGINS

(See page 8).

Brains—How Come?

By ALLAN STRONG BROMS

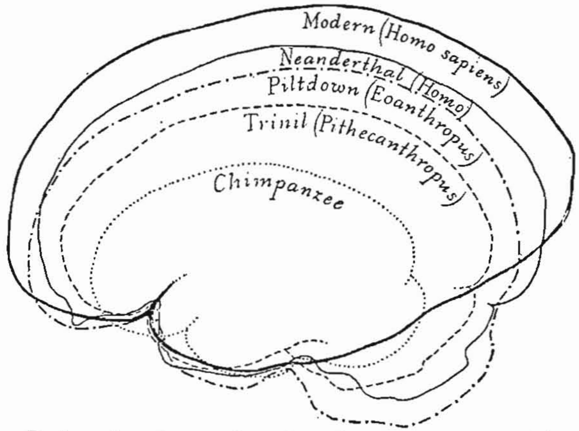
HIS better brain makes man supreme over the other animals. The gap is wide between him and his nearest rival, so wide that even some scientists once took exception here to the theory of evolution. They admitted the probability of physical evolution; but surely that wonderful thing, the human mind, must have been specially created and implanted. Just how, they did not explain. Perhaps, at bottom, this reaction was not reasoned, but rather the prejudice of pride which demanded for superior man superior origins and graces. Nevertheless, there is a real problem here, the problem of how man got that way. The modern scientific answer is that man's hands made his brains.

Chimpanzee

Man's close relatives have all died out, but some second cousins, the anthropoid (man-like) apes, still live. For mere animals, they have pretty good brains, stand almost humanly erect and have hands and use them. We shall find that hands make brains, so they might well be getting somewhere if man had not beaten them to it and crowded them off the high road. Now they haven't a chance.

But they do have the family look. Just compare them with some of the old family portraits we have dug up. We really had to dig for them, these portraits, for the family album is the earth itself and the portraits are the fossil bones we have found. It must be confessed that the earliest grandfather of them all, old Pithecanthropus Erectus of Java, was an unlovely low-brow. He was not an ape, oh no, but he certainly had the marks. In the scale of brains, he stood right between the ape below and ourselves above.

But just how did man get his brains? Well, he just happened to get the right training. Then too, Nature gave him several good boosts. His hands, however, can take most of the credit. With hands he handles things, examines them, does things to them. He always learns best by doing. He learned reality by doing, for it really works. Apply an idea and you test it. If it is true, it works; if false, it fails. Man got his truths that way. As he does his doing with his hands, he got his truths through his hands.



Brains of modern and prehistoric men compared with that of chimpanzee.

This does not mean that he acquired some true knowledge that way and that his children inherited the memory of that knowledge. Nor does it mean that after handwork had trained and developed his individual brain, that his children inherited this bettered brain. We are pretty sure that characters acquired by exercise and training are not inherited.

No; this was one of those partnerships between a thinker and doers, in which either would fail without the other. Brains are usually assets, but never more than minor assets if they have no hands to do their stuff. Look at the horse; of what use is a bright brain to him, since he can use it but little? Then consider the elephant with his handy trunk (not at all bad as a hand) that gives him a chance to use his brain and therefore gives him a good brain. In the struggle for existence, characters acquired by variation will tend to survive, and to develop by further selective survivals, if they give advantage, increase fitness. Brains without hands never amounted to much, so they did not evolve. Brains with hands meant a lot, so they evolved rapidly.

Java Ape-man

Courtesy J. H. McGregor

If you want to know how handy your hands are, tie them up for a while and learn your helplessness. Or try picking up pins with your toes. Even practice will not help much, for the foot is built wrong. Its thumb does not work right. The hand's thumb is a dandy. It is set on a flexible and rotating joint; it can be placed opposite the fingers for the picking hold. This makes the hands handy. To prove this, hold your thumb and try picking up pins with the fingers only. It makes a good game, but it is not handy.

As long as we travelled on four feet, the hands were kept busy as feet and could not develop into real hands. This held the brain, the partner, down too. Luckily for us, one of our ancestors made just the right move.He climbed into the trees. That is how he got his hands. The brain followed.

Very likely, this ancestor was a little fellow who fled to the trees for protection. He was probably much like Tarsius of the East Indies, a squirrel-sized, primitive lemur (semi-monkey) who has several very human characteristics besides hands. Instead of climbing by clawing, as squirrels and cats do, he climbed by grasping. Slowly, by natural selection, he and his monkey descendents developed hands and feet with thumbs. Of course he still used his hands mainly as feet and only occasionally as true hands. But his brain got its start, for at last it began to count through its performing partners.

The hands divided their job between them. The left hand hung on to keep the balance, while the right got real clever at manipulation. The one got the stupid job of just holding things, while the other got the handyman's job of picking things apart. So the one stayed awkward, while the other became "dexterous", which is just Latin for right-handed. Sometimes Nature trades about and makes the left hand clever and the right hand dumb, but it takes just this kind of a pair, a holder and a picker, to make the unbeatable combination.

Some of the descendents grew big, much too heavy for tree life and so they took to the ground. In the trees they had acquired the semi-erect attitude which partially freed the hands and as the free hands were too handy to lose, they became more and more erect. In walking, they kept their weight on the hind feet and for all practical purposes, the hands were free. Thus it happened that the partnership of "Hands and Brain" got its big chance. The junior partner soon grew up and now runs the works.

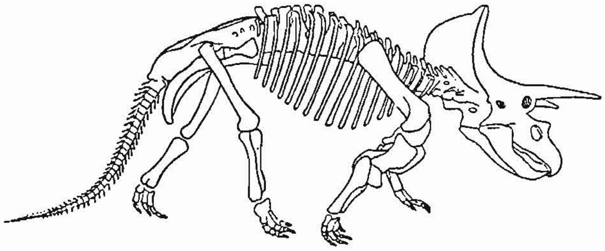
The hands did another good job. They picked up sticks and stones and *used* them for tools. Further directed by the brain, they also *made* tools by chipping and grinding and carving. Now, instead of cracking nuts with the teeth, they used a heavy stone. Instead of tearing tough meat with the teeth, they cut it up with a stone knife. The tools of the hand relieved the heavy work of the jaws and the jaw grew smaller. The lower face receded, while the growing brain-case bulged upward. Man became a high-brow.

The erect attitude helped too. It shifted the resting point of the head. The head no longer hung, it balanced. The physiologists tell us this changed the neck and helped to free and develop the organs of articulate speech. Speech meant that we could pass ideas around and thus learn from each other. Later we also learned to write our speech and then we could pass our ideas along down through the ages. Knowledge then began to accumulate and each generation could start off where the last one left off. That meant progress in knowledge.

But this is only the story of how man's hands helped him get his brain. His two eyes had something to do with it too, but that is a story for the next issue.

The Horned Dinosaur Triceratops

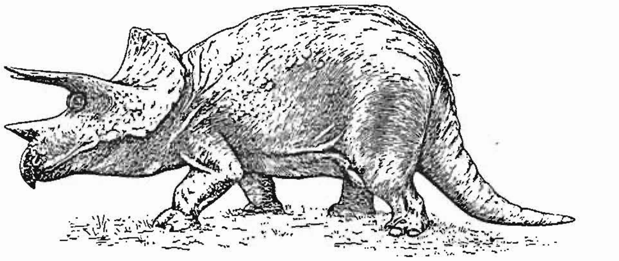
The greatest wealth of material illustrating evolution is to be found at the American Museum of Natural History, 77th Street and Central Park West, New York. Readers of EVOLUTION around New York will live more interesting lives if they form the Museum Habit, and visitors from out of town should be sure to spend at least a day at the Museum. It is open free every day of the year, weekdays from 9 to 5, Sundays 1 to 5. Each issue of EVOLUTION will contain an illustrated article describing some exhibit of special interest to students of evolution.



Skeleton of Triceratops.
Courtesy Am. Mus. Nat. Hist.

IN the great Hall of Dinosaurs on the fourth floor will be found the skeleton and reproduction of Triceratops, He of the Three Horned Face, a huge plant-eating reptile whose hoofs, horns and general proportions suggest a giant rhinoceros, but with the horny beak of a turtle and a good set of grinding teeth. The back of the skull is expanded into a great bony plate, a combination of horns and buckler pivoted at the centre on the neck so that it could be turned to meet attack from front or side. The body was not protected by a bony armor, but the skin was tough and leathery, with raised scales. It weighed about ten tons, twice as much as an Indian Elephant. It had straight hind limbs like the other dinosaurs, but its fore limbs bowed-out as in large modern lizards. It had an everlasting supply of teeth, for as those in use wore out they were replaced by others from below. Its chief enemy was the giant carnivorous dinosaur Tyrannosaurus whose skeleton is exhibited nearby.

Triceratops is one of several related species of dinosaurs common in western North America in Cretaceous times sixty to one-hundred million years ago when that part of the continent was lower and the climate milder. In an adjoining hall are the skulls, skeletons and famous eggs of small dinosaurs from the desert of Mongolia, thought to be its ancestors. The National Museum in Washington and that at Yale University, Cambridge, Mass., also have fine Triceratops exhibits.

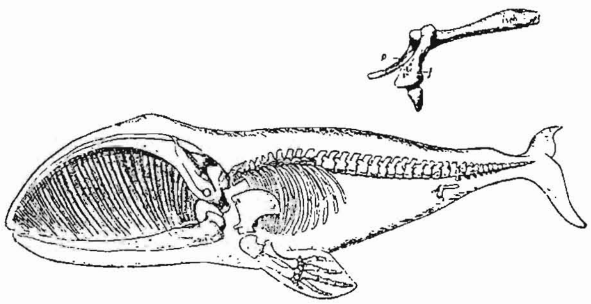


Triceratops restored to flesh.
Courtesy Am. Mus. Nat. Hist.

Vestigial Organs

By HUGH F. MUNRO

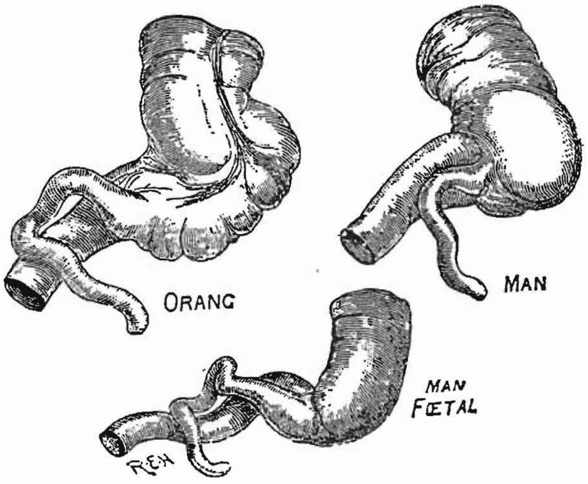
IF animals have evolved from one form to another, the changes must frequently have entailed the disuse of old organs and it is to be expected that the late forms would still have such organs or vestiges of them, either wholly or in part functionless. Such vestigial structures would then tell the story of the animal's past, the nature of its habitat, and its mode of life. The fact that whales and certain snakes have recognizable vestiges of limbs can only mean that these animals have descended from ancestors with legs. The presence of incisor teeth in the embryo calf and of teeth in the embryo parrot can only mean that the ancestors of our cattle had upper incisors and that the ancestors of modern parrots were toothed. This inference is borne out by the fact that birds with teeth occur as fossils in the Cretaceous deposits of Kansas and in the Jurassic of Germany. The clearly developed third eye on the top of the head of a New Zealand lizard (Sphenodon) indicates that certain vestigial structures in the roof of the brain in certain reptiles, birds and mammals are the remains of such an organ of sight.


Skeleton of Greenland Whale (reduced to 1-200th) and rudimentary leg-bones somewhat larger.

According to Wiedersheim, there are about 180 such rudimentary structures in the human body, all indicating an evolutionary relationship with lower vertebrates. Examples are to be seen in the tailed human embryo, muscles of tail and ear, hair follicles, bronchial clefts, pointed ear, vermiform appendix, etc. Changes due to the recently acquired erect position are found in the shifting of the pelvic girdle, the descent of the genital glands, the changed positions of the navel, heart, stomach, thyroid and thymus glands. Had man any other than an evolutionary origin, such structures would not be present and the fact that they all point in one direction completely cinches the case.

But this is not all. Man changed to the upright position so recently that many of his bodily parts have not yet adapted themselves to the change. That the upright position is not yet wholly natural is clearly manifest from the difficulty which every child experiences in learning to maintain it. In no other species do the young have to learn by a long and laborious process of conscious effort to acquire the usual posture of the adult. In the case of animals that go on all fours, the limbs are attached at the "four corners" of the body in such a way as to divide the load between them and thus lighten the burden of each. On the other hand, when man took to walking erect the entire weight of his head and body was thrown upon his hind legs. In order to support this shifted weight, relatively greater development was forced upon the hip bones and legs, but this was not so serious as the various curvatures of the spine which ensued. Man is the only animal, with the partial exception of the anthropoid apes, in which the backbone is necessarily curved to make more easy the support of trunk and head, and in those apes the amount of spinal curvature is in direct proportion to the uprightness of their postures.

Another consequence of the recently acquired erect attitude is the depression of the viscera into the abdominal cavity, leading to that painful form of rupture known as "inguinal hernia", a derangement unknown among quadrupeds.



Our vestigial vermiform (worm-like) appendix.

REVERSION

By reversion or atavism is meant the sudden and sporadic reappearance of some ancestral structures which had been either entirely lost or greatly reduced.

Reversions are usually to be found in structures that have changed their form within a comparatively recent time, and in every case they revert to a previous condition. In man the occasional excessive development of the canine teeth is a reversion to a form usual to the anthropoid apes, whose canine teeth are very large and are used as weapons. The occasional occurrence in man of tail muscles, and even of the tail itself, a complete coating of hair and arrangement of muscular and bony systems not adapted to the upright position, are all due to reversion. If they do not indicate stages on the road over which man has traveled, then what do they mean?

EMBRYOLOGY

Every individual plant or animal, including man, begins its life history as a single cell, and gradually passes by slow stages of cell-division and differentiation into the adult condition. In doing this, each individual passes through successive stages which have preceded it in the line of its tribal history. In other words, race history is repeated in individual history. The length and complexity of this process are proportional to the complexity of the adult form. Thus the complete life cycle of many of the lower multicellular animals and plants is passed through in the course of a few months, while the body of a man requires twenty years or more to attain its full development. During the months of his prenatal existence he, too, sums up his tribal history, as he quickly passes from the unicellular stage successively through the invertebrate, fish and mammalian stages, to emerge at last, a human being.

Dividing his uterine life into three periods, at the end of the first he has four gill slits, no lungs and a tail which is one-third the length of his body. His brain is the same relative size as that of any other vertebrate, and at this stage the embryo can hardly be distinguished from that of any one of the higher mammals.

During the second period the gill slits are still present, but the tail is less than one-fourth the length of the body, while the legs are mere knobs.

During the third period, the tail generally, but not always, disappears; the gill slits have gone, the lungs have been developed; still the embryo is distinguished only by the larger size of the head. After birth the great toe standing out from the others is reminiscent of the grasping toe of the ape-like form, and arboreal tendencies are shown by the young child without training clinging to any support that it can grasp.

Prof. H. H. Lane (Professor of Zoology, University of Kansas) tells us that "even an experienced embryologist dare not preserve a series of mammalian embryos without carefully labeling each at the time it was secured, for it is almost impossible to determine whether a given specimen is human, pig, rat or cat, if the labels be misplaced even on specimens fairly well advanced in development.

The Story of Plant Evolution

We have just received a leaflet under the above title, written by Dr. Alfred Gunderson of the Brooklyn Botanic Garden. It presents an interesting but much neglected aspect of the story of evolution.

AS animal life depends upon plant life for its food, it is obvious that land animals could not develop until the plants had taken to the land. The plants led and the animals followed. Both originated in the water and in their long evolutions passed through three main stages; water, marsh and land life. "The Cambrian, first of the Paleozoic periods, shows exclusively water forms. Individual development often more or less recapitulates water ancestry. . . . The swimming sperms of the ferns and cycads remind us of their former surroundings, The tadpole stage of a frog is essentially a fish. The mammals, including man, pass through a stage with gills plainly showing. . . .

"The animal world is entirely dependent upon plants for its existence. And so both worlds have developed side by side: the water animals from the beginning have fed on the algae (seaweeds); the cold blooded reptiles, on gymnosperms (needle-leaved plants such as our evergreens) with comparatively little nourishment; the mammals, in general, on the more nutritious angiosperms (broadleaved higher plants). The lowest animals are floating or stationary; food is absorbed from the sea. They differ but little from the lowest plants. Higher animals have movement; with an alimentary canal and circulation of blood, they carry, so to speak, a condensed ocean inside of themselves. Similarly the highest animals, warm-blooded, may be said to carry climate inside. More heat required more food, so the broad leaved angiosperms, with grasses and fruit, had to come before mammals and birds could develop."

Many interesting facts are brought out, "Water plants need no special organs to take in moisture, for it surrounds them." Hence they have no true roots, but merely root-like "rhizoids" to anchor them on the stormy shore. "True roots have root hairs and conducting tissue to carry water and solutions." Only the higher marsh and land plants have them. The valuable discussion of the rather complex development of spores and seeds cannot well be summarized, but it tells the same story of an evolutionary beginning in the water.

"To regard our conscious motives as the real reasons for our important acts is but a degree removed from the savage who thinks that the changes of the seasons are made by his magic. The unconscious is like the filterable virus; like the dark side of the moon; like the vitals of the ship which are invisible below the water line; like the radium emanations which cannot be experienced, but which are necessary for the interpretation of other phenomena."

—From *Mental Adjustments* by Wells.

"In an ideal University . . . . the force of living example should fire the student with a nobler ambition to emulate the learning of learned men, and to follow in the footsteps of the explorers of new fields of knowledge. And the very air he breathes should be charged with that enthusiasm for truth, that fanaticism of veracity, which is a greater possession than much learning; a nobler gift than the power of increasing knowledge; by so much greater and nobler than these, as the moral nature of man is greater than the intellectual; for veracity is the heart of morality."—Thomas Huxley.

Mastodon Facts vs. Fundamentalist Fancies

By Walter C. Kraatz

Uninformed anti-evolutionists, dabbling with data regarding well-known extinct animals, often attribute to these creatures far greater size than they possessed and draw startling conclusions, as in the naive statement of the fundamentalist that the huge size of the dinosaurs and mastodons made it impossible for them to get into the ark and caused their extinction. Readers will remember the fine cartoon on this idea in April Evolution.

Lately the discovery of a mastodon tooth in our county brought to light more of the same fundamentalist ideas. The incident is worth telling, if only to correct such ideas with real data on the nature and size of this extinct mammal. Elephants, mammoths, mastodons and some antecedent relatives constitute the order Proboscidea, the name referring to their trunks.

The tooth in question was exhibited in a drug store window with an astonishing label, full of erroneous "information". I offered a large label in correction, but when the willing drugstore manager saw that my data demolished that of the first label (even though he had had no hand in its production) and that I mentioned the evolution of the elephants, he did not post my label, explaining diplomatically that he wished to avoid contention. Instead he took down the exhibit.

The finder had stated on his label that the tooth was as old as the deluge, which is entirely unscientific. It probably dates from the last glacial recession some 30,000 to 50,000 years ago.

Mastodon teeth are not rare. Numerous skeletons also lie buried in the glaciated country and many are mounted in the museums. We have one tooth, but no skeleton, in our biology department at Akron.

The imaginative writer of the original label said that judging from the size of the tooth, the mastodon must have been 40 to 60 feet long and 20 to 26 feet high! Of course no American mastodon or other living or extinct land mammal was ever found anywhere near that large.

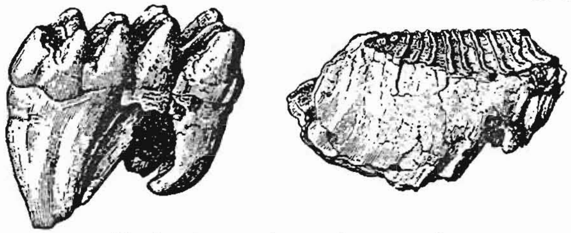
Mastodon Americanus, the species from which the tooth came, was scarcely as large as our present day Indian elephant. Prof. Lull, in his "Organic Evolution", has a good chapter for those who want to know the nature and evolution of the Proboscidea and states that this species ranged from 7 to 9 feet tall. Another reliable book is "Animals of the Past" by Dr. Lucas, published by the American Museum of Natural History.

In a recent article in Natural History (Jan., 1925) Dr. H. F. Osborn gives a tabulation of body heights from all the latest data. The American mastodon was 9 feet, 6 inches tall, the Woolly mammoth 9 feet, 3 inches, the Indian elephant (living) 10 feet, the Jeffersonian mammoth 10 feet, 6 inches, the African elephant (living) 11 feet, 4 inches, and finally the largest that ever lived, the Imperial mammoth 13 feet, 6 inches. Thus the American mammoth was not as tall as the present living Indian elephant, and the tallest of African elephants nearly approaches the height given for the Imperial mammoth.

We can roughly judge the size of the mastodon from his tooth, provided we know our elephants. But the original label writer and other fundamentalists do not know them. Probably he judged the mastodon's size on the basis of the difference in size between a human and his molar.

Several body features of the elephant changed much in the millions of years of his evolution. The head particularly became much larger and notably high, appearing even foreshortened, as big air spaces developed in the upper parts of the skull. The molars became fewer and larger, the upper incisors tusks. A trunk or proboscis developed. The American mastodon, however, did not go quite so far in this development as have the present elephants.

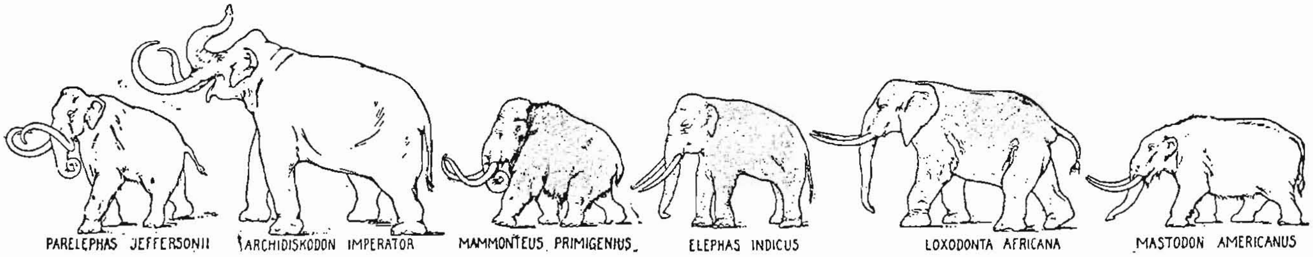
The American mastodon had two large molars on each side of the jaw. The crown of the one I have measures 8 inches long and half as wide. The tooth in the drug store was a bit smaller. But though the label writer had probably never seen another tooth, he stated on his label that his find was the biggest and most perfect tooth ever found. Aside from being a rather small specimen, it is not the most specialized type evolved.



Teeth of mastodon and mammoth.
Courtesy Am. Mus. Nat. Hist.

The mastodon molar always had a few rows or ridges across the crown, usually five when fully developed, each ridge consisting of two fairly distinct conical elevations. But the mammoth, genus Elephas, a highly developed member of another line of Proboscidea, had a still larger and more specialized molar, and moreover only one on each side of the jaw. It was longer, and had more and narrower ridges across the crown.

The mammoth molar is of the same type as that of the living elephants, which have evolved from the mammoth line. Anyone acquainted with elephant teeth would recognize the mastodon molar as being relatively less developed and specialized. We must not expect, however, that an anti-evolutionist, discoursing on mastodons and their teeth, would know any of these facts, nor think of studying an elephant, nor take the trouble to find out the real facts. Indeed, the less he bothers with facts, the less his imagination is hampered.



Comparative sizes of living and extinct Proboscidea.

Clergymen As Scientific Men

Over half a century ago (October 26, 1876), an editorial under the above title appeared in the New York Nation. We reprint extracts of present interest.

"THERE is no denying that the theory of evolution, if true, does, in appearance at least, militate against the account of creation given in the first chapter of Genesis as held by the Christian world for seventeen centuries. It would, therefore, be by no means surprising that ministers should meet it, either by showing that the Mosaic account of the Creation was really inspired, or that it was, when perfectly understood, easily reconciled with the conclusions reached of late years by geologists and biologists. This is the way a great many ministers have hitherto met the evolutionists, and for this sort of work they are undoubtedly fitted by education and experience. If it can be done by anyone, they are the men to do it. If it be maintained that the biblical account is literally true, they are more familiar than any other class of men with the arguments accumulated by the church in favor of the inspiration of the scriptures; or, if it be desired to reconcile the Bible with evolution, they are more familiar than any other class of men with the exegetical process by which this reconciliation can be effected.

"Of late, however, they have shown a decided inclination to abandon the purely ecclesiastical approach to the controversy. They do not seek to defend the biblical account of Creation or to reconcile it with the theory of the evolutionists. Far from it, they have come down into the scientific arena, and are meeting the men of science with their own weapons.

"Noticing their activity in this new field, we asked ourselves whether it was possible that, without our knowledge, any change had of late been made in the curriculum of divinity schools with a view of fitting ministers to take a prominent part in the solution of the increasingly important problems raised by physical science. We turned over the catalogs of the principal divinity schools to see if candidates for the ministry had to undergo any instruction in geology, paleontology or astronomy, or had to become versed in the methods of scientific investigation in the laboratory. Much to our surprise, we found nothing of the kind. We found that, to all appearance, not even the smallest smattering of natural science is considered necessary to a minister's education; no astronomy, no chemistry, no biology, no geology. In fact, of special preparation for the discussion of such a theme as the origin of life on the earth, there does not appear in the ordinary course of our divinity schools the smallest trace.

"We then said to ourselves, But ministers are modest, truthful men; they would not knowingly pass themselves off as competent on a subject with which they are entirely unfitted to deal. Perhaps the training given in the divinity schools, though it does not touch special fields of science, so disciplines the student in the work of collecting or arranging facts of any kind, and reasoning from them, that, though he may not have a scientific man's knowledge, he will have his mental habits.

"But we found this second supposition as far from the truth as the first one was. Moreover, the mental constitution of the young men who choose the ministry as a profession is not apt to be of a kind well fitted for scientific investigation. Reverence is one of their prominent characteristics, and reverence predisposes them to accept things on authority. They are inclined, too, to seek truth rather as a means of repose than for its own sake, and fancy that it is associated closely with spiritual comfort, and that they have secured the truth when they feel the comfort. They enter the seminary with a strong bias in favor of one particular view of the origin of life and the history of the race, and their subsequent studies are marked out and pursued with the set purpose of strengthening this bias and of qualifying them to defend it and spread it, and of associating in their minds the doubts or rejections of it with moral evil. The consequence is that they go forth, trained not as investigators or enquirers, but as advocates, charged with the defense against all comers of a view of the universe which they have accepted ready made from their teachers. A worse preparation for scientific pursuits of any kind can hardly be imagined. The slightest trace of such a state of mind in a scientific man discredits him with his fellows and throws doubt on his statements."

The editorial then speaks of clerical attacks, "put together with considerable rhetorical skill and seasoned with flippance, and presented to make it appear that the Huxleys, Haeckels and Darwins who have supported evolution, and given to it years or lives of laborious and conscientious investigation, were a set of charlatans or dreamers, whose chief use was to make clerical lectures 'funny'. What was most melancholy about it was, not the assault on laborious investigators by gentlemen whose acquaintance with the subject is at best very small, but the apparent unconsciousness of both orator and his audience that there was anything absurd or humiliating in his position. Let us assure the ministers who enjoy and participate in this sort of sport that it is not the men of science they are injuring or degrading: it is their own order and vocation.

"The history of the relation of religion to science has consisted in the main of the acceptance by theologians of scientific hypotheses over which they at first laughed or were angry. Would it not be well for ministers to abandon the attitude of angry fugitives toward science, await its discoveries with calm, and watch the tentative efforts by which all its truths have been revealed with friendly, or, at all events, courageous interest? For though a good ally, it may be a terrible, because inevitable enemy."

"The Moving Finger writes, and, having writ,
Moves on; nor all your piety and wit
Shall lure it back to cancel half a line,
Nor all your tears wash out a word of it."

EVOLUTION

A Journal of Nature

To combat bigotry and superstition and develop the open mind by popularizing natural science

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HENSHAW WARD WRITES NEW SERIES

For our Arkansas Campaign Henshaw Ward is writing a special series of three articles, presenting THE EVIDENCE FOR EVOLUTION in the simplest, clearest, non-technical language possible so that ordinary people that have never studied science will be able to understand it.

These articles will appear in the September, October and November issues of EVOLUTION on the following subjects:

1. The Evidence from Breeding.
2. The Evidence from Field Work.
3. The Evidence from the Laboratory.

If you have read Henshaw Ward's Evolution for John Doe, which we deem by far the best book on evolution for laymen yet published, you will have an inkling of what a treat is in store for you. If not, please accept our assurance that you will enjoy these articles so much that you will want all your friends and neighbors to read them too. So prepare yourself to spread these three numbers of EVOLUTION among them.

You will really be doing them a big favor, for the reading of these friendly talks by Henshaw Ward will widen their mental horizon and enable them to live more interesting lives.

Without containing any "preachments" whatever, Henshaw Ward's writings have this quality of quickening the minds of the readers. That's one reason why we asked him to write this series of articles. It is seed that will grow, and we expect every reader to plant some of it in his community.

"To decide that a principle is untrue simply because of the consequences which misguided people may eventually think themselves able to deduce from it, although in itself it is proven and accurate, is certainly both a perverse and mischievous strategem."—Reclam.

Arkansas Battle Begins

A battle has begun in Arkansas which in time will involve the people of the entire United States and perhaps the whole English speaking world. Organized bigotry has hit upon a new method to attain its ends. It will win many victories. It will grow stronger and make a scrious bid for supreme power. And all the while it will be digging its own grave. YOU may live to bury it.

FOR THE FIRST TIME IN HISTORY

the question of evolution is to be submitted for popular referendum. Fundamentalists have succeeded in placing it on the ballot in Arkansas, forcing the people to vote on it at the next election. Shall it be unlawful to teach that *"man has ascended or descended from a lower order of animals"? YES* or *NO.* Four hundred thousand voters in Arkansas, their passions and prejudices aroused by preacher and politician, are to answer.

OSTRICH-LIKE

many men of science seem to hope to solve this problem by ignoring it. Self-styled "lovers of intellectual freedom" make wise-cracks about Arkansas, considering it of no importance what happens in the "back-woods". Some hunt shelter till the storm blows over. Others think it doesn't matter as long as it does not affect their immediate personal jobs. Meanwhile the fundamentalists are in deadly earnest about it. There may be demagogs among their leaders, but most of them have the

FRENZIED FANATICISM

that used to burn witches. They actually believe that the issue involves eternal bliss or hell-fire everlasting for themselves and their children. A score of their religious journals contain broadsides against evolution and evolutionists in every issue. In an article reprinted on the opposite page their chief spokesman declares a

WAR OF EXTERMINATION

against the teaching of evolution. They propose to keep on until it is "forced out of every public school on the American continent". An idle threat? What is to stop them? As long as the fundamentalists tried to get anti-evolution laws only through the legislatures there was a good chance to defeat them. It was possible to present the positive evidence of evolution to the legislators that had to decide the question, but how will you submit the evidence to the voters of a whole State? This new method of appealing to popular referendum gives the fundamentalists a tremendous advantage for the present and practically assures their victory in Arkansas. And this Arkansas referendum is not an isolated event. The battle beginning there is only

THE FIRST SKIRMISH

of a battle that will have to be waged in every one of the twenty States that have an Initiative and Referendum Law. Certainly the fundamentalists have enough little local preachers in each one of these States to pass around petitions among their flocks and can easily get the signatures that are necessary to place the question on the ballot. When they have carried these States they will make their try for national control. Sounds fantastic? Remember that they have popular prejudice on their side. Moreover these fundamentalists have learned some lessons from the

ANTI-SALOON LEAGUE

and they boast that they will not only apply them, but improve on them. At any rate, they have ample funds and they mean business and they are going through with their program. What do you propose to do about it?

Do we feel discouraged at the prospect? Despair of the future of humanity? See Dark Ages ahead? On the contrary, we consider this the

MOST WONDERFUL OPPORTUNITY

for mass enlightenment that has ever presented itself. Ordinarily most people do not bother their heads with scientific questions. They follow their mental rut. But now the fundamentalists will force them to vote on evolution. Thousands, yes millions will want to know what it is all about. And EVOLUTION proposes to tell them in plain, simple language what it means to apply the scientific method, and what science has learned about nature. The more fundamentalists agitate the question, the more opportunities they will create for

POPULAR EDUCATION

and we propose to take full advantage of them. While they may win victories they will also dig the grave in which all superstition will be laid to rest forever. We hold that all the anti-evolution laws that fundamentalists can pass will be nullified by increasing knowledge of the people. EVOLUTION, therefore, takes up the fundamentalist challenge fearlessly and confidently, and will meet it boldly and squarely. We

SHALL NOT SIDE-STEP

the issue by claiming that it is merely a matter of keeping church and state separate. We shall not quibble about the unconstitutionality of anti-evolution laws. Neither shall we stultify ourselves by pretending to reconcile the discoveries of science with supernatural religion. We maintain

EVOLUTION IS A FACT.

Man HAS descended from a lower order of animals. From every field of natural science we shall marshall the evidence until no intelligent human denies it, until militant fundamentalism disappears from the face of the earth and science reigns supreme.

In this great work we invite the cooperation of every reader.

The Fundamentalist Challenge

Here we reprint the Challenge of Fundamentalism as voiced by Rev. W. B. Riley, President of the World's Christian Fundamentals Association, in an article on Evolution vs. Creation, or Darwin vs. The Divine Word, published in The Bible Champion, August, 1928.

IN a series of twenty debates on evolution, the writer has met the president of the Science League of America, Maynard Shipley; Professor J. B. McCabe of England—both rationalists. He has also met Dr. Edward Adams Cantrell, then field secretary of the Civil Liberties Union of New York, and Dr. L. M. Birkhead of Kansas City, both Unitarian preachers. He has also met Professor Burts of the University of Chicago, and Professor Metcalf, the southern biologist, both professed Christians, and Charles E. Smith, president of the American Association for the Advancement of Atheism. He has found no difference whatever in the views of these men. They are one in their opposition to the God of the Bible and its claim of inspiration.

We have met these gentlemen in debates in practically every state in the union, and we have, in the judgment of adult audiences, uniformly defeated them. Dr. John Roach Straton was victorious in his debate against evolution in New York. Dr. Arthur I. Brown, the noted surgeon, has defeated every evolution exponent who dared to meet him in an open forum. Professor Harry Rimmer has met no man, in the many debates he has held upon this subject, who proved his match. The writer of this article recently concluded his twentieth debate in New Orleans, having as his opponent Charles Smith, president of the American Association for the Advancement of Atheism. He suffered the same fate that had befallen his predecessors, Maynard Shipley, Edward Adams Cantrell, J. B. McCabe, L. M. Birkhead, and others. If their theory is so certainly established, it seems unfortunate that they cannot find for it a capable defender.

It is certainly amusing to have these mental weaklings, who have gone down in every contest, go about the land indulging themselves in speeches, and written articles concerning "the ignorance" of their opponents. If we could not more than match them, man for man, in mental strength and forceful arguments, they would destroy one another, for no two of them are agreed upon any of the details of this irrational, atheistic, unscientific theory. They do to one another what the Philistines did in the day when Gideon, with his 300, went after them with lamps and pitchers. Each of them "sets his sword against his fellow," and they engage in a mutual slaughter, while the fundamentalists hold in their hands the torch of truth and look on the brotherly butchery.

They are growing increasingly chary of open debate.

It is difficult for Brown, or Straton, or Rimmer, or the writer, to find men who will dare attempt to defend the philosophy in the open forum of adult audiences. They are extremely brave in the presence of little children of "the third grade," and even young men and women of college age, who are careful not to excite the professors' displeasure by exercising an independent opinion. But to prove to the public that they are cowards, when faced by men of equal age and competence, we hereby challenge their most outstanding representatives—David Starr Jordan, Henry Fairfield Osborn, Professors Conkling and Davenport. We dare anyone of them, or all of them in turn, to meet us in the discussion of this subject before the very universities in which they themselves are instructors, and then on the night following, in a proper place before the general public, submitting the merits of the debate to the majority vote. It would seem, when a subject is shaking the entire land, that the men who are so certain of their ground, would come to the defense of the truth, if they have it. We dare them!

We charge that the course pursued in this matter is cowardice.

Fundamentalists live in the confident expectation of victory. We have won already many states. Tennessee outlawed this atheism; Mississippi outlawed this atheism. Albert C. Dieffenbach, its most ardent exponent, after reciting the states in which either an anti-evolution law had been passed, or existing laws interpreted to prohibit such instruction, or the proposed law defeated only by crooked politics, admits, "There is a distinct gain for the Fundamentalists. These people will come up again, and again." In that matter Dr. Dieffenbach is right. We do not expect so much to "come up again and again," as to stay up.

Maynard Shipley, in the March number of *Current History*, sensibly says, "Nothing but a vigorous State-wide opposition campaign can save the day for Arkansas next November"; and again, "Oklahoma is particularly menaced. . . . There is far less organized opposition to anti-evolution agitation in Oklahoma than in Arkansas"; and then (it makes us smile to record it), he continues, "From present indications, unless a strong organized counter attack can be established, Oklahoma is culturally doomed." How pathetic! To some men, the unproven speculation of Darwin is Science; to others, it is "cultural," and to atheists it is both; but to men of the highest intelligence, it is *bunk*.

Let it be understood, fundamentalists propose a war of extermination. We have met some defeats; never yet a fair one. We have won some victories, but whether we meet defeat or victory, we are in the fight to stay until this atheistic religion is forced out of every public school on the continent.

Dr. Dieffenbach was intelligent enough to note the parallelism between this fight and that against the liquor traffic, and in his article some months since, he sanely reminded his readers of possible parallelism by saying, "The struggle for prohibition, which, by the way, made no such amazing political headway in its first fifty years as the present Fundamentalist foray has done in half a decade, would never have got anywhere without the churches."

There are men who imagine that the churches are dead, and we admit that those who are in the hands of modernist ministers are on their way to the grave. But, fortunately, there remain thousands and tens of thousands of preachers who have not as yet succumbed to this skeptical speculation and under whose leadership Christian America will yet speak the doom of the Darwin skepticism now falsely named "Science!"

LET US ANSWER THIS FUNDAMENTALIST CHALLENGE

by sending copy of EVOLUTION with Ward article to each of

FOUR HUNDRED THOUSAND FAMILIES IN ARKANSAS

during this campaign, while they are agitated about the question. We have a method of reaching them, but not the necessary funds. Since it costs about five cents per name it will take

TWENTY THOUSAND DOLLARS.

Make remittance payable to EVOLUTION, 96 Fifth Ave., New York, and specify *FOR ARKANSAS EDUCATION*

The Scientific Method

By EDWIN LINTON

(Reprinted from Science)

THE struggle between that spirit in man which urges him to seek an explanation of things as they are and that spirit which prefers to rest upon the slumber-wooing bosom of tradition has been the theme of many learned treatises and of innumerable disputations.

The line of cleavage separates those who arrive at truth by way of the scientific method from those who frame their beliefs in accordance with some traditional authority.

When reduced to its simplest expression the term scientific method is no more than those processes which every normal person employs, whereby, through observation, experimental tests, and comparison with knowledge already possessed, he arrives at a reasoned conclusion.

An example of the employment of the scientific method, while it may seem trivial, since it is drawn from the experiences of a boy who, at the time he first used it, probably never had heard of the word science, will serve my purpose rather better than one which might call for the use of technical terms.

On a bright morning following a quiet fall of snow, a boy out hunting notices certain marks in the snow which, instead of being haphazard, are in quite orderly arrangement. They are in groups of four, much as be could make by pressing two of his fingers, held some two or three inches apart and nearly side by side and two other impressions made in the same way but one in front of the other and some eight or ten inches from the pair of parallel marks. Moreover, a line joining the paired impressions is nearly at right angles to the line which joins the other two.

He observes that these groups follow one after the other, a few feet apart, and form an unbroken line which stretches between a patch of blackberry briars and a brush-heap. His discerning eye notes that the two parallel impressions are consistently at that end of the group which points towards the brushheap. So much for his observation of facts. Next follows what might be called an experimental test, at least a search for additional facts. Keeping at some distance from the brush-heap, he walks around it, meanwhile carefully examining the snow. Suppose that he finds the snow which surrounds the brush-heap free from orderly placed markings other than the one line of impressions which connects it with the briar-patch. His acquaintance with such signs as these teaches him that a short time before a rabbit left the briars and hopped in the direction of the brush-heap. His investigation of the available facts thus far, since in the language of the fable, there are no returning footprints, justifies his very reasonable hypothesis that there is a rabbit in that brush-heap. Imagine that boy's disgust if some traditionalist passer-by should object to the validity of his reasoned conclusion, call it impious and inform him that these marks were placed there by the creator of the snow or else were freaks of nature.

This would be no more an affront to reason than much which stands written against the rational interpretation of fossil footprints. For instance on page 155 of "The Dogma of Evolution," is printed this criticism of paleontological conclusions: "The positive evidence of so momentous a change of structure (appearance of Amphibia) to be derived from six footprints seems a slender one on which to base the continuity of evolution." Which naturally makes one wonder whether eight footprints would be convincing, or if there had been but four, whether they could be admitted as evidence at all.

Of course our hunter may be quite ready to admit that, while the evidence at hand points to the conclusion that there is a rabbit in the brush-heap, further investigation may show that there is no rabbit there. For example, a hawk may have swooped down and carried it off through the trackless air, but if that were the case there would be some evidence that such a tragedy had been enacted.

Some thirty years ago, more or less, towards the close of the day, I unpacked a lot of material which had been collected by the Rev. W. E. Johnston, missionary to West Africa. Among much other interesting and valuable material were the skull, the bones of a hand, and the skin of a hand of a large male gorilla. This material I had left lying on a table in my room in the college. When I entered this room on the following morning, I found the janitor, John Washington, so deeply engrossed in an investigation in comparative anatomy that he did not reply to my morning greeting. He was holding the little finger of the gorilla beside the corresponding finger of his own hand. The nails on the fifth digits of these representatives of two genera of primates, *Troglodytes gorilla* and *Homo sapiens*, var. *Africanus*, thus laid side by side, were practically identical in shape, color, and differed not greatly in size. Instead of answering me in his usually polite manner, he said: "What is this?" I told him that it was the hand of a gorilla. His next question, and there was in it a tone of mingled awe and reasoned conclusion, was: "Are they like us?"

Indeed the scientific method is simply the natural reaction of man to his surroundings when not hampered by the taboo of traditional authority. His method of arriving at truth is in no way changed when assisted by instruments of precision, or by devices which increase the range of his sense organs.

If those zealous people who have appropriated, without what seems to be an appealing justification, the name Fundamentalist would consult their own common sense, and apply the scientific method to an examination of the anti-science tenets of their theology, they might be led to remove a lot of the hay and stubble which has got into their foundations.

Remarkable Case of Atavism Among Pigeons

By HOWELL S. ENGLAND

WHEN, as a boy at home, I had just finished reading, surreptitiously, Darwin's "Origin of Species", I was much struck by the variations from the original wild rock dove shown by the various breeds of domestic pigeons.

I had a variety of pigeons,—Pouters, Duchess, Antwerp, Jacobins, Fantails and Outside Tumblers. In order to experiment whether a pigeon resembling the blue rock dove could be produced by crossing these various breeds, I mated them purposely so that the mates would be as divergent as possible in size, formation and coloring. In one of these cross matings the cock bird was an Antwerp (blue checker) and the hen a Brown Tumbler.

From the first pair of eggs only the smaller egg hatched. The larger, too, was fertile, but the little pigeon had apparently died in the shell.

Examination showed that the upper mandible of the bill was missing, the lower mandible being of full size. The structure of the upper jaw ended at the nostrils. Otherwise the young pigeon had been vigorous, but it had five perfectly formed toes, the original normal number, on each foot, three pointing in the normal direction and two reaching backward, somewhat as in a Houdan or Dorking chicken. The wings had the ordinary two toes consolidated at the joints, making the point of the wing, but the other three toes, which in the ordinary pigeon are reduced to one little jointless projecting point, were supplemented by a second projecting point, so that it had five toes on the feet and four on the wings.

I sent the specimen to the Philadelphia Academy of Natural Sciences, where it was kept as an interesting instance of partial reversion to original type.

Readers of EVOLUTION who live in the country or who may be breeders of pet stock of any kind, should watch carefully for all such illuminating variations and report their discoveries to the nearest museum of natural history as well as to EVOLUTION.

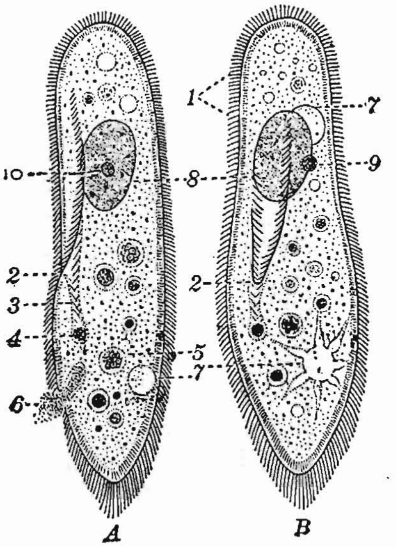
The Amateur Scientist

A Monthly Feature *conducted by* Allan Strong Broms

PARAMECIUM, THE SLIPPER ANIMALCULE

Paramecium is a very active one-celled animal found in stagnant water. To raise a herd of him, soak some grass in a tumbler of water for a week or two, without changing the water. It will turn muddy and brown, and smell like sin, but it will be full of interesting microscopic life. Sharp eyes can detect moving motes in a drop of this water held up to the light. Placed on a glass slide under a low powered microscope (20 to 30 diameters), this drop of water is found to contain various transparent little animals, the most obvious and active being paramecium.

It is shaped like a lop-sided slipper, hence its popular name, the "slipper animalcule". It swims with somewhat of a corkscrew motion, impelled by fine, hair-like *cilia* which wave rapidly back and forth like oars. A higher magnification (50 to 100 diameters) will show these cilia when they are at rest and something of the creature's simple structure, among other things its funnel-shaped mouth at the instep part of the slipper and its pulsating excretion-spot near the end.



PARAMECIUM: A left side; B. under surface; 1. cilia; 2. mouth; 3. gullet; 4. food entering; 5. food within; 6. excretion spot; 7. breathing bubble; 8. big nucleus; 9. small nucleus; 10. nucleus center.

Patient watching may also show how the animal reproduces. It gets thin at its middle, starts whirling around rapidly. Its waist gets thinner and thinner until it finally breaks and the two parts fly apart, each part a paramecium of rather squat shape which soon grows to normal size and form. Should the drop of water dry up, the paramecium dries with it and may actually die. But you never can tell, for this speck of dust may preserve the spark of life and some day, when it gets wet again, will swell out into life and activity, just as it must have done to start the colony in your tumbler of dirty water.

MICROSCOPES

MICROSCOPES are magnifiers used for enlarging and viewing small, near objects. There are two general kinds, simple and compound.

Simple microscopes, which may consist of one or more lenses set close together, are called magnifiers, examples being reading glasses and pocket lenses. They are designated by their focal distances which determine their magnifying powers. To find the focal distance of a lens, use it as a burning glass and measure the distance at which the sun's image is smallest, clearest and brightest on the surface being burned. The more curved the surfaces of a lens are, the shorter the focal distance. the higher the magnification and the smaller the field of view. Large reading glasses are always low powered, while high magnifications are possible only with small lenses with very curved surfaces. To find the magnifying power of a lens divide ten inches by its focal distance. Thus a lens of one inch focus magnifies ten times, one of two inches focus, five times, etc. In using magnifiers, the object should be in the best light and the lens should be held close to the eye.

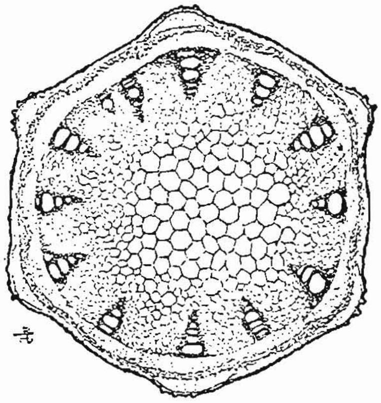
In the *compound* microscope much higher magnifications are secured by using two lenses or groups of lenses, one of short, the other of long focus and set some distance apart. To keep them and the object in line and at proper distance, they must be mounted rigidly in a frame of metal which we usually call the microscope stand. It has a foot for firmness, a stage on which the object is placed, a tube for the lenses and of course the connecting framework. Mechanical means are usually provided for changing the relative positions of the lenses and the object, called the focusing *adjustment*. A mirror, flat or concave, with perhaps a lens condenser, is used to throw concentrated light on the object. As the object is usually a thin slice or a shallow drop on a glass slide, it can be best illuminated by bringing the light from below through a hole in the stage.

The short focus lens near the object is the *objective*, the longer focus lens near the eye is the *eye-piece or ocular*. In the better instruments, the magnifications can be changed, not only by using different combinations of these lenses, but by means of a draw-tube for changing their distances apart, for the farther apart they are, the greater the resulting magnifications. To get a distinct view, the object must be at exactly the right distance from the objective lens. High power instruments are therefore provided with two adjustments for moving the tube up and down, a coarse adjustment for approximate focusing and a fine (slow-moving) adjustment for exact focusing.

The student of biology who wants more than a book knowledge must very soon resort to the microscope. A cheap magnifier will help the eye a lot, but a compound microscope of good make should be in the hands of every serious student.

THE CELL UNIT OF LIFE

The unit of all living beings is the cell, which is ordinarily microscopic in size. It consists essentially of a jelly-like mass (the *cytoplasm*) within which is a denser *nucleus*. In animal structures, the cells may not be easily distinguished, only the nuclei being really distinct, but in plants the cells are clearly separated by definite walls. Some cells, used for water storage, are very large, as in the cactus stem, the begonia leaf or the pulp of the lemon, orange or grape-fruit and can be seen with the naked eye or a low-powered microscope. To see their inner structure, one must, however, use a powerful microscope (50 to 100 diameters).



Cross-section of bean stem.

In outer shape, cells vary greatly, being round, long, flat or branching. The nuclei within also have many shapes, from round to a long corkscrew. Cells may contain other things, such as grains of starch or chlorophyll (the green coloring matter of plants) and foreign matter. But whatever its shape or functions, each cell lives and grows and eventually dies. It multiplies itself by subdividing into parts which become distinct cells.

The whole organism may consist of only one cell, as the amoeba or paramecium among animals and some algae (green water scum) among plants. It may consist of a few cells strung together in chains or bunched into little bundles, each member of the colony being and functioning alike, with no division of labor between them. Or the organism may be built up of millions of cells of various kinds, grouped into tissues of like cells, each tissue group having its own special work to do and all cooperating by dividing between them the many labors of the body as a whole.

Funnymentals

"Is the American Museum of Natural History misspending the taxpayers' money and poisoning the minds of school children by false and bestial theories of evolution? Ought not the Bible to be exhibited at the Museum as well as a lot of musty old bones?" Reverend John Roach Straton, quoted by Shipley in "War on Modern Science".

"If anyone wants to teach that God-forsaken, hell-born, bastard theory of evolution, then let him go out and let him be supported by the men who believe that blasted theory and not expect the Christian people of this country to pay for the teaching of a rotten, stinking professor who gets up there and teaches our children to forsake God and makes our schools a clearing house for their God-forsaken politics. (Applause)."

Reverend William Ashley Sunday, D.D., before congregation at Elmira, N. Y., quoted by Alumni Journal of James Millikin University, Winter, 1925, Page 27.

"It were better to die with Christ than to be cured by a Jew Doctor aided by the devil." Protest by Wuertemberg clergy against granting of privileges to Jewish physicians.

"Satan produces all the maladies which afflict mankind, for he is the prince of death . . . he poisons the air; . . . no malady comes from God." Luther, quoted by Andrew D. White, II, p. 45.

"The anti-evolution law is nothing more than a modern application of the ancient law of blasphemy. Under it it has long been a criminal offense to publicly 'deny the story of God's creation' with intent to 'alienate the minds of others from the love of and reverence of God'." Attorney Eugene McSweeney of Tennessee in Christian Fundamentalist.

Our Jokesmith Stumped

Reverend Professor Leander S. Keyser, D.D., in "Bible Champion," August, 1928, pp. 413-414 (italics ours): "Evolution now means that all forms of present-day life have emerged from a primordial germplasm, which somehow or other came into existence as a moneron, *proton,* or amoeba. . . ." ". . . it means that man . . . harks back to the primordial *proton* or amoeba."

Evidently the Reverend Professor of Fundamentalism thinks the nucleus of the atom is some sort of a bug! And he's author of a volume exposing the fallacies of Evolution!

(If anybody can rewrite this joke and improve it, he has my blessing. One can't quite explain straight out that a "proton" is the positive electric charge at the center of an atom. Yet one can't quite assume that everybody knows.)

EDWIN TENNEY BREWSTER.

EVOLOOSHN

By EDDIE BOINS

DIS guy Mister Man is some bolony; maybe he don't like hisself, ha! Now dat he can git up off his grubhooks onta his hind legs an order a coupla weenies at Coney Island, maybe he don't high hat his poor relashns de shimpanzee and de gorilla.

But didja ever see him at de Museum? Does he mit his old granpop de apeman when he bumps inta him? Betcha life he don't—he aint gonna reckernize him if he can help it.

One of dem syentific boids at de Museum let out some line about it de oder day. He claimed dat youse could see de resemberlance every time.

Accordin to dis pertesser boid, Mister Man usta sure get away wit it. But jist about de time he kidded hisself dat he was makin de grade an puttin it acrost good about how his folks usta live on Park Avenoo on Toity-toid street he got one slick acrost de mug. An who done it? Jist an old bozo named Darwin who horns in an tells Mister Man where he gits off.

"Hey youse," says dis Darwin guy, "git wise to yesself—git wise. Yer genuwine famly tree is smeared all over yer body.

"Say, it's some pedigree ya got," he says, "foist youse was a poor fish mopin about in a prime-evil swamp. Den youse was some kinda crawlin ting wit a mug like a bullfrog,—only not so bright, wot I mean.

"Next youse was a furry little animal sumpn like a rat but wit a bobcat's temper. It took millions of years afore youse could climb up de trees an hang onta dem wid yer tail. Den youse begins to sit up on yer hind legs an loses yer tail. About dat time youse gits to look like Happy Hooligan in de funnies."

Fellahs, youse can knock me for a row of ashcans if dat der perfesser warn't de cats whiskers wit dis syentific stuff, wot I mean. Off he goes again, like dis:

"Bime-by," he says, "Mister Man gits chaste outa de trees an begins runnin on de streets like de Patchin Place gang. Den, later on, de saber-toothed tiger chases him an he beats it to de caves. Den dis ting dey calls de Ice Age come along an he has one helluva time slidin down de glaciers an fillin de Hairy Mammoth's hide full of pins wit chipt arrows.

"Onct de cave bear comes up an takes a squint at him. Jist as de bear shoves his bean inta de cave Mister Man jumps up an shoots him one acrost his smeller wit a carved war-club. Out goes Mister Bear—yep! Out like a light.

"By dis time Mister Man gits to be a reglar guy an learns how to bean his old woman wit a stone axe. Foist sign of comin civlizashn, wot I mean.

"After dat he gits inta de Neo Stone Age. Boys," says de perfesser guy, "here's de nigger in de wood-shack: About dat time some wisenheimer gits ta find out about farmin. Dat Bimbo gits Mister Man in bad, cause den de hull famly had ta git ta woik. An de hull mess of peoples has had to woik ever since.

"Dat's where de monks has de laff on us."

LETTER FROM A FUNDAMENTALIST

To the Editor:

While in Portland today I picked up a copy of your interesting, albeit bigoted and intolerant publication. I enjoyed reading it, although I am something of a "funny mentalist", not however of the Straton type, who is a liability rather than an asset to Christianity.

The copy was of the March issue and I wish some of our hyphenated Baptist "funnymentalists" who try so anxiously to reconcile Modernism and Christianity and keep both within the same organization, could read your editorial on Pussyfooting. Regardless of which is right or wrong the sooner we recognize that if one is right the other is wrong and that there isn't room for them in the same bed, the better off we'll be. Intellectual ostriching is neither scientific nor sound ethics.

But I wish you would be more scientifically tempered toward us "funnymentalists". Granting, for the sake of argument, that you are right, it would be as scientific to blame a monkey for not having evolved beyond his tail, or to blame the earth for not having evolved beyond cataclysmic volcanic eruptions as to blame us for not having evolved beyond our primitive superstitions to the grand intellectual heights to which it is allowed for argumentative purposes you have evolved.

It has been said that the state of a man's mind is as much of a fact as the condition of his stomach, and the state of our funnymentalists' mind is as much of a scientific fact as is the state of a monkey who has not yet evolved to the estate of man.

Please be patient with us, as you would be patient with the monkey, for not having evolved to your plane. For from your point of view we are simply a study in psychology, a scientific study, and you should study us as dispassionately and with the same equipoise as you would study a volcano. We are not bigots, no more than a volcano is bigoted. Perhaps our chemical processes are not correct. Maybe we need some sugar—although on second thought we are probably not lacking in courage. But certainly if you are so doughty a believer in science you will study us scientifically to discover the scientific causes of our mental (?) phenomena. Or are we outside the sphere of science? Strange indeed that some have so much pathological patience for the criminal and none for us.

Sincerely,

PAUL S. WHITCOMB.

"How easily men ignore facts when blindfolded by a preaccepted theory."—Henry George.

Illustrated Evolution Lecture

We have now in preparation an illustrated lecture on "The Animals of the Past", consisting of colored stereopticon slides and full lecture text, which will be rented to readers of EVOLUTION for presentation in their communities. You can now announce an evolution lecture, get these slides for the date set and deliver you own lecture on the basis of the authoritative and interesting text we provide. A stereopticon outfit can usually be secured locally. Many schools and halls have them. You can charge a small admission or take up a collection to meet the expenses.

This lecture is being prepared by Allan Strong Broms, associate editor of EVOLUTION, for several years science editor for the largest slide house in the country and for more than twenty years one of our ablest popular lecturers on science. The subject, "Animals of the Past", has been selected from his series of over thirty illustrated lectures on evolution as the first for revision and popularization.

Write us for further details as to rental charges, dates, etc. Put your application in at once so that we may know how many sets to prepare to meet the demand and so you may be sure of getting the lecture on the date you want. Additional illustrated lectures on evolution will be prepared and made available as your demand warrants. With your cooperation, this can be made one of the most effective and convincing methods of promoting the understanding of evolution.

More X-Ray Experiments

Can we effect growth and sex of animals by somehow treating their eggs? It would seem so according to the report of three years experiments conducted by Dr. W. H. Dieffenbach and Mrs. J. F. Ranken published in the June issue of the Journal of the American Institute of Homeopathy. Chicken eggs were exposed to action of X-rays for definite periods of time and the results in the chickens compared with those from eggs not thus treated. Three important and very definite results were noted.

First; short exposures (8 minutes being best) with filtered X-rays stimulated the growth of the chickens.

Second; long exposures (from one to five hours) reduced the growth of the chickens.

Third; most interesting, the five-hour exposure resulted in none but female chickens. Dr. Mary B. Stark, the embryologist, suggests that this was due to the prolonged exposure destroying a basic chromosome (heredity-bearer in the germ cell) thus permitting only the female chromosome to develop.

GROWING UP—By Karl de Schweinitz, The Macmillan Company, N. Y., $2.50.

This book tells how we become alive and are born and grow up.

It is a story that has happened to everybody, to your neighbors next door, to your mother and father, and to you.

We are all interested in it. We have all been babies and we have all been born, so, of course, we want to know how we came into the world.

It is to tell boys and girls this story that I have written "Growing Up".

Karl de Schweinitz.

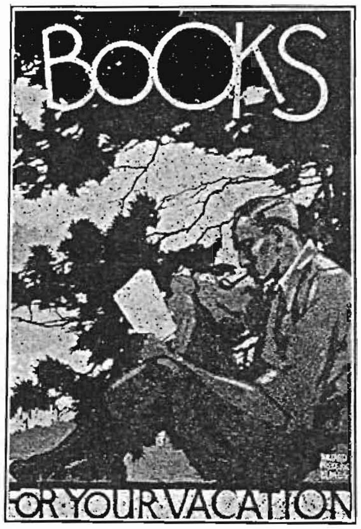
THE FALLS OF NIAGARA. *By Glenn C. Forrester.* D. Van Nostrand Co. $2.50

No spot in America is so packed with geologic interest as the gorge of Niagara. Coral reefs and ripple-marked shores of ancient seas, rocks scratched and grooved by the hob-nailed heel of the glacial ice sheet, pot-holes being formed under the clear waters at your feet, pot-holes of other days marking old stream courses and levels, a great pre-glacial Niagara gorge now traceable only by deep well borings through the glacial debris that fills it, such are some of the mere incidents of the tale here told. The main story is of receding ice sheets, the changing Great Lakes ponded between the ice bank on the North and the ridges and glacial rubbish to the South, the tilting of the earth-crust heaving upward in relief when the mile-thick ice sheet melted away, each change altering the Great Lakes outlets so that now the Niagara channel was brimming full and now quite robbed of its stream.

The story of the falls begins at the northern brink of the Niagara plateau. It took thousands of years to recede to its present position by headward cutting of its gorge. Each change of outlets from the Great Lakes affected the rate and depth of gorge cutting. When the flow was great, the deep and wide portions of the gorge were rapidly cut; the shallow and narrow portions resulted when the stream was scanty. Midway in its work and recession, the falls reached the buried preglacial gorge, cleared a portion of it with a rush (the present Whirlpool basin) and then again resumed its slower work of cutting the upper gorge through the solid rock strata.

All this makes a geologic story that has long needed telling. Two million people visit Niagara each year, but not one in a thousand sees a tenth of the wonder. This book will open their mental eyes. It will also guide their feet, for the last chapter gives an effective one day tour of the scene. The pictures and diagrams are ample and effective and the rest is just plain talk, no technicalities, no writing for effect. This very significant incident in earth evolution has been very well, because clearly, told. The scene itself is, of course, beyond words and the author has most properly not tried to find words for its wonder.

A. S. B.



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From Our Readers

"It always gives me a thrill to hear something about evolution and natural science, not because it is my hobby just now but because its mission is to free the world from superstition and slavery.

"This time of year always finds me a little in debt, but here is a dollar for broadcasting. I hope I can do some real pushing about December when people begin to read here.

"I have not been able to go anywhere on account of work, so have not made you the $1,000.00 will yet. Would like to favor several organizations that are trying to further natural science, but have no faith in our local County Attorney, so if you can write several blanks in favor of EVOLUTION I would be pleased to fill one in with my signature and may be lucky enough to find some other no good old bachelor who would do likewise.

"But as I said before, I do not intend kicking in right now. I intend to find a sweetheart and see the world before I kick in, Old Mexico and Russia preferred." A reader out West.

"Herewith M. O. for £1.15. Please forward EVOLUTION 12 mos. to following six persons. For the balance send us copies of next issue of EVOLUTION. These we intend to use as specimen copies and hope from them to be able to forward a considerable number of new subscribers." Rationalist Assn. of Australia.

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the youth
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most dear.
Taught us that we relentless war might
wage
Against base slavery of every kind;
Taught us to face intolerance's rage
While we tear off the shackles of the
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Contributions from the following supporters of EVOLUTION have made it possible to bring out this August issue and again send several thousand copies to prospective subscribers:—

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Of course we cannot expect many to equal the record set last month by A. Nielen, but every reader CAN send AT LEAST FIVE new ones, and that will do the trick. The great series of articles by Henshaw Ward and our special Arkansas Campaign offer (see back page) will make it EASY.

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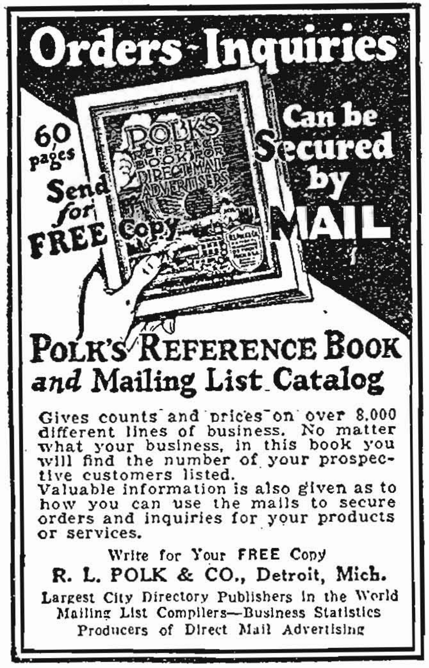
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Save Arkansas!

SHALL EVOLUTION BE OUTLAWED?

Another American state is menaced. The first anti-Evolution referendum ever held occurs in Arkansas, November 6th. Orthodox Christians, organizing rural ignorance, seek to emasculate education by denying children the truth of Modern Science. There is no opposition, except a group of compromising, camouflaging, scared-to-death pussy-footers, who dare not attack Christianity or the Bible, behind which the Enemy takes refuge.

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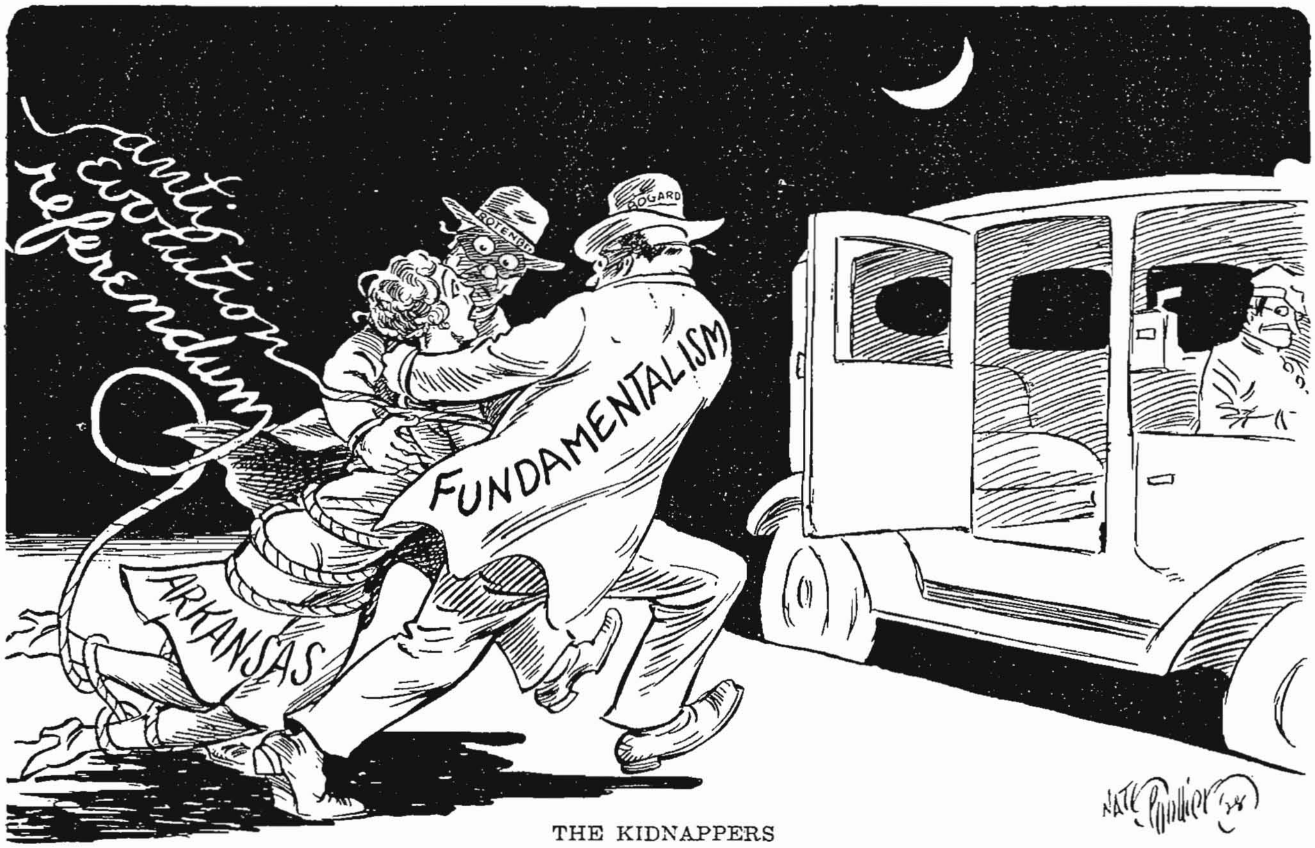

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2. Evidence from Field Work (for October.)
3. Evidence from Laboratory (for November).

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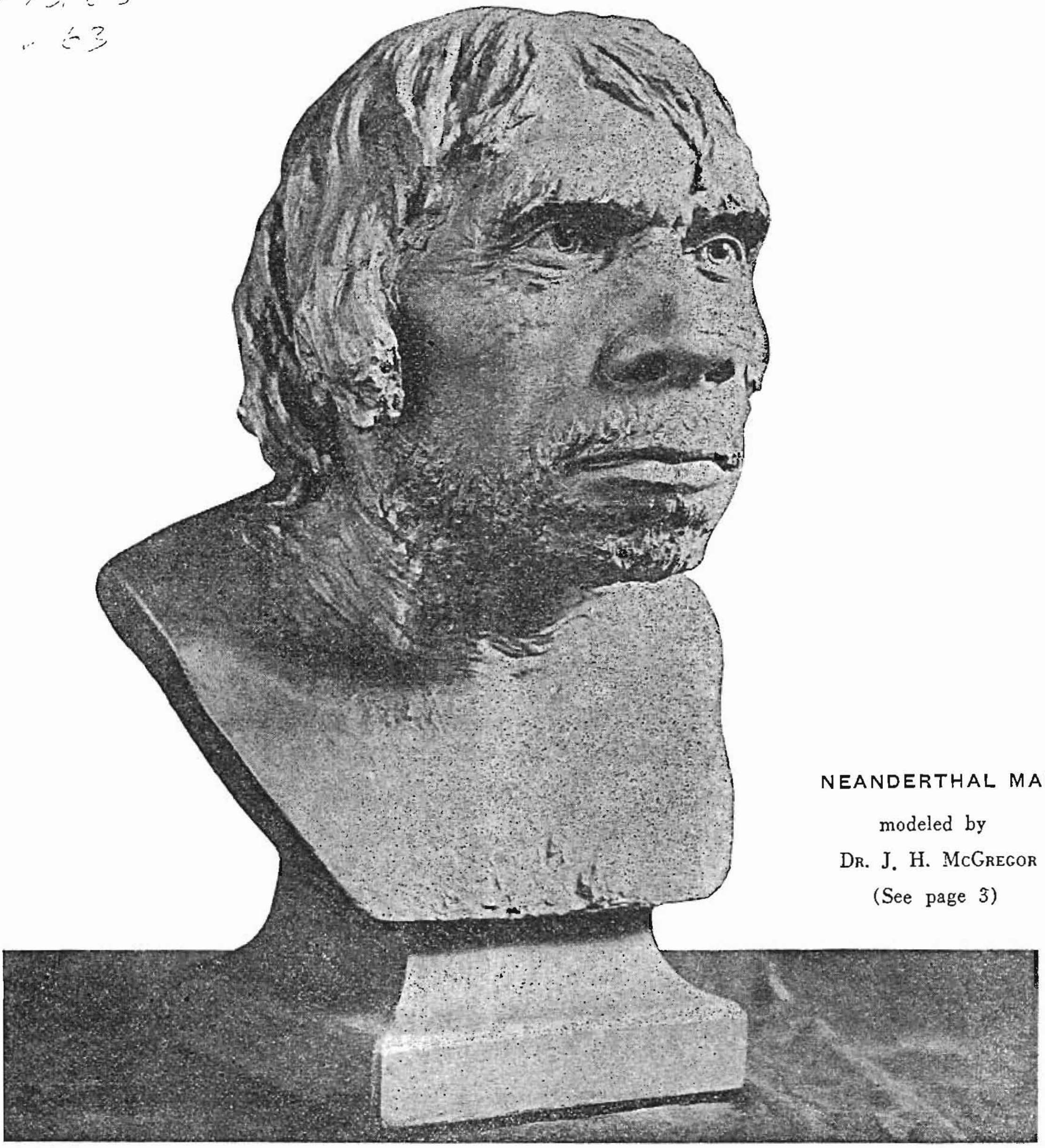


NEANDERTHAL MAN

modeled by

Dr. J. H. McGregor

(See page 3)

Beginning —

THE PROOFS OF EVOLUTION

By Henshaw Ward

The Proofs of Evolution

By HENSHAW WARD

(An outline of the proofs of evolution will be presented in three articles, of which this is the first. The second article, "What the Rocks and Geography Prove," will appear in October; the third article, "What Structures and Embryos and Blood Prove," will appear in November.)

I. THE SPECIALISTS ARE UNANIMOUS

WHEN Darwin had worked for more than twenty years on his theory of evolution, he submitted the evidence to three skeptical men in whom he had the most confidence: the keenest anatomist, the most observant geologist, and the most hard-boiled botanist in the world. They examined the evidence critically; each decided that Darwin might be wrong, but might be right. Even if they could have got together as a committee and could have devoted their time for a year to threshing out the evidence, they would not have been wise enough to announce a final verdict, of Proved or Not Proved.

HENSHAW WARD

No man was ever wise enough to judge a theory by merely using his own mind on the evidence. The most acute mind has to wait to see what flaws other men will find. Since scientists are all eager for fame, it is certain that some of them will detect every weakness. As the years go by, the judgment of specialists will crystallize: if the great majority of them vote no, the theory will probably die; if all specialists finally vote yes, the theory becomes a part of our common culture and is taught in the colleges. Every theory has to run the same merciless gauntlet.

A good parallel to evolution is the astounding theory that the earth moves around the sun. This is the weirdest and most incredible idea that ever had to endure the whipping and clubbing of the learned world. For we can *see* the sun moving around us, and no eye will ever behold directly the proof that we move around the sun. During twenty centuries the theory of the earth's motion was considered a comical guess. But it was gaining favor in 1600, and had a majority vote by 1700. So much new evidence for it came through lenses that the astronomers had accepted it unanimously by 1800.

But of course many learned men in other lines remained doubtful for a time. So late as 1850 there were college professors in the United States who would have preferred that this humiliating and atheistical theory of a revolving earth should not be taught to their students. So late as 1880 a colored orator of Richmond, Uncle Jasper, was famous for his address, which he delivered hundreds of times, "The Sun Do Move." Leading white men of Richmond testified to the mental ability and high character of Uncle Jasper, though they found it hard to forgive his speechifying in favor of an antiquated bit of theology.

In 1860 the evolution theory seemed to most scholars as comical as the theory of the earth's motion had once seemed. They wrote thousands of articles and books against it. In 1870 the ordinary educated man could not tell whether evolution was going to live or die. In 1880 he had to be dubious. By 1890 most of the leading biologists and geologists had accepted evolution, and it was entered in encyclopedias as a well-established part of science. By 1920 no reputable biologist could be found who doubted evolution. People who orate against it in 1928 are just like Uncle Jasper—well-meaning men who think by the standards of a past generation.

The Uncle Jaspers of 1928 do not understand what "a unanimous vote of specialists" means. They suppose that scientific knowledge can still be debated by hashing up ancient ignorance and spouting it eloquently. They are not afraid to argue against atoms or disease-germs or radio—against any part of science that is unanimously accepted by the only men who know. An Uncle Jasper thinks that his own powerful mind is able, by itself, to judge scientific evidence and decide pro or con.

But the wisest man in the world cannot tell, from mere reading of books, whether the earth does move or microbes do cause scarlet fever. The evidence is highly technical and complicated; the best expert might be misled in its mazes. All that you and I can do is to see a simple outline of the evidence and then resolve not to be Uncle Jaspers holding out against a unanimous decision of the specialists who devote their lives to study of the question.

So I have put this proof—the biggest and most important—at the beginning. It is the one that must be our guide through the other proofs. No one of the proofs that follow is convincing in itself. Each is just a section of the whole mass of evidence. And the whole mass would not be convincing if it were not for this great fact: The combined proofs have been unanimously accepted by specialists.

II. WHAT BREEDING PROVES

Evolution means to some people that "man is descended from monkeys," but in science it means that all forms of life have developed from simple ancestors. Darwin's studies began with the changes in plants and animals; his conclusions about man came at the end of his reasoning. These articles will follow Darwin's course and will begin with an experiment in plant-breeding.

For fourteen years the Inter-Continental Rubber Company has employed specialists to domesticate a rubber-bearing shrub that grows in Mexico and Texas, "guayule" (gwi-u-lay).* Great issues depend upon this breeding.

---

* See the admirable article by D. T. McDougall in the *Scientific American* for July, 1928.

For America needs 66% of the world's rubber, but controls only 2½% of the rubber plantations; so keen and desperate is the rivalry for rubber that it may become one of the causes of a great war; to produce rubber is now a national necessity. So we may be sure that the hard-headed managers of a great corporation and the hard-headed Dr. MacCallum whom they employ are not working by any empty theory. They are not guided by feelings about philosophy or theology. They are strenuously trying to get hold of more rubber by methods that are most likely to secure results.

Dr. MacCallum's method is the basic principle of evolution, and the steps of his work illustrate one line of proof of that theory. He believes in evolution as thoroughly as a cotton-grower believes in rain; and he knows that an enemy of evolution is an enemy of industry and civilization and horse sense.

In the first place, he knows—as every farmer knows—that a young rubber plant will be very much like its parents. It will inherit all their traits of forming roots and leaves and filling its tissues with a rubber that can be made into Ford tires. This is the principle of "heredity." It is no more theoretical than a rubber tire. Offspring tend to resemble their parents.

But Dr. MacCallum also knows that no young plant ever resembles its parents completely. It may have been a trifle speedier in sprouting from its seed; it may be slightly more able to withstand drought; it may be somewhat more able to endure a cold summer; its fibers may contain a higher percentage of rubber. Every plant and animal varies to some extent from being an exact duplicate of its parents. This is the principle of "variation." It is no more a theory than a steering-gear is.

For fourteen years Dr. MacCallum has been busy selecting those shrubs that have varied in ways which will make them more profitable as domesticated plants. First he selected from a bewildering lot of wild varieties the few that were most promising. Then from the offspring of these he selected the variations that tended to sprout and develop at the times that are best fitted for Texas and California farming. Of course he discarded all rubber plants that were varying in the direction of producing less rubber. By saving the right variations and discarding the wrong ones he was gradually producing the sort of plant that can furnish automobile tires. For the selected variations are preserved and transmitted by heredity to succeeding generations. This is the principle of "selection." It is no more theoretical than the price you will have to pay for an inner tube if the United States cannot grow its own rubber.

All breeders of plants and animals have known for centuries this method of selecting favorable variations and building up what is useful to man. It is the process which has given us the valuable varieties of wheat, corn, roses, cattle, horses, and fowls. There is not a farmer in the United States who thinks that this process of breeding by selection is untrue. Every farmer knows that selection is the foundation of modern agriculture.

Darwin wondered whether there might not be in nature a process similar to this artificial one. He knew that some variations must help a plant or animal to do better in the struggle for existence, and that some variations must be unfavorable and cause it to die. "May it not be," he wondered, "that the conditions of life are always killing off unfavorable variations and allowing only the favorable ones to multiply?" If this was the case, then the forces of nature would always be tending to preserve variations in certain directions and to kill them off in other directions. If nature had operated thus over very long periods of time—millions of years—it might gradually have caused an animal to become vastly different from its remote ancestors. Perhaps all the millions of varieties of plants and animals had been produced by this sort of evolution.

Darwin did not fall in love with his new theory just because it looked pretty. Nor would scientists ever have accepted it just because it seemed probable. Evolution would have remained a mere guess if no other kinds of evidence had been discovered. The other kinds will be described in the next two articles.

McGregor Reconstructs Ancient Man

By ALLAN STRONG BROMS

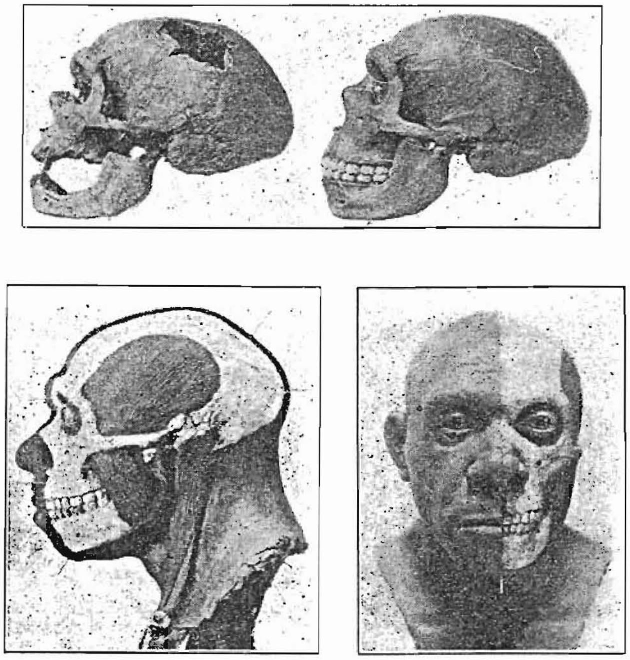
IN the Hall of the Age Man in the American Museum of Natural History are several busts of prehistoric races of man. They have been modeled by Dr. J. H. McGregor, Professor of Zoology at Columbia University and Research Associate in Human Anatomy at the Museum. This means that they are the best racial portraits our present knowledge permits, for Dr. McGregor is a careful and skilled sculptor-anatomist and devoted a good part of five years to the making of these likenesses of the ancient races of mankind. This was no mere work of artistic imagination, but a task of scientific accuracy done by the man who has made himself the world's foremost authority in his field.

Our cover this month shows his reconstruction of Neanderthal man, whose race lived in Europe some twenty-five to seventy-five thousand years ago. He told the story of its making. For a start, he had plaster casts of many fragments, several fine jaws and seven fossil skulls upon which to base it. The skull of La Chapelle-aux-Saints, France, which had proved to be most complete when pieced together, was used as the base for this particular head. As the original fossils, besides all being in European museums, were much too delicate and valuable, plaster casts were used throughout the work.

The first job was to restore the missing teeth and nasal bones by comparing similar parts from kindred remains, making them over, of course, to fit the parts that were intact. The hole in the skull was readily filled by using the other half as a model. On this nearly perfect cast was then modeled the fleshly form. With his other duties, this took him one whole year, so exacting was the work.

The next step was to model the neck. Its fossil bones were available as a guide and were carefully drawn full size in vertical section. The other vital parts, muscles, ligaments and organs, were then filled in as exactly as possible and upon this basis the outer form was built. The skull was then poised on this reconstructed neck in its natural position. The neck proved to be thick, but no such "bull" neck as had hitherto been assumed.

The larger muscles of the temple, between the jaws and alongside the neck were modeled with considerable assurance, for their points of attachment were obvious and even their sizes could be gauged closely from the skull itself. The multitude of minor muscles make a relatively smooth covering of flesh and could be modeled on in accordance with normal local thicknesses. Exhaustive preliminary studies were made to learn these thicknesses, which were first marked on photographs of the skull for reference purposes and then transferred to the skull-cast itself as little guide pins cut off at proper heights above the surface. The final flesh model was then filled in until it just covered these pins, but to make absolutely sure, the thicknesses were laboriously checked and corrected by probing through with measuring needles. All this took months of work.



Three stages in modeling Neanderthal head: 1. Original skull pieced together; 2. Skull cast, missing parts restored; 3, 4. Side and front view of half and half model, basic modeling on left. outer face modeling on right side.

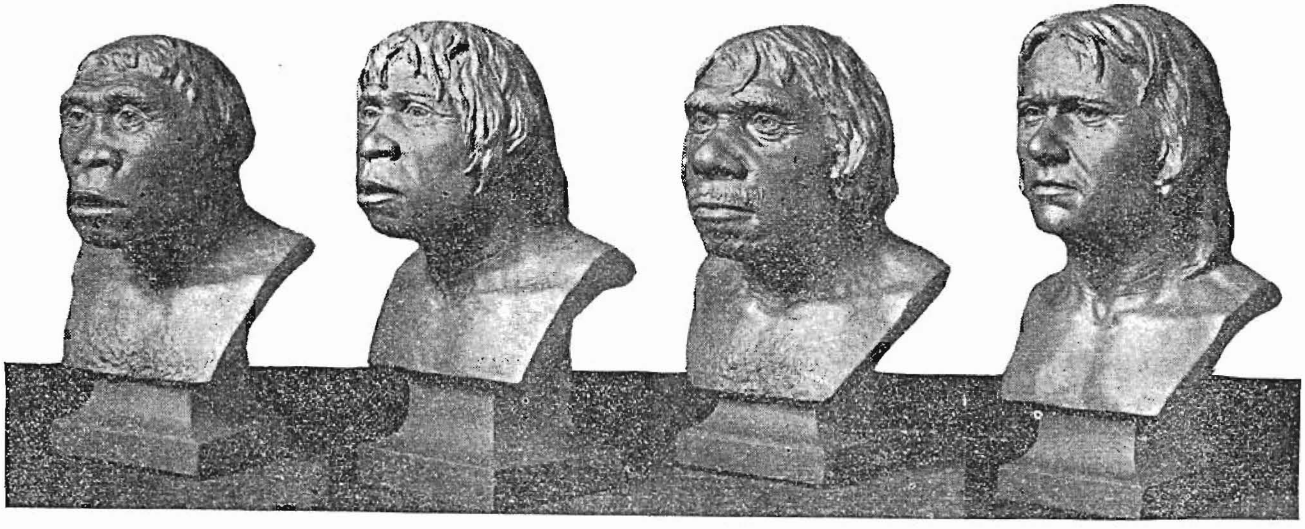
Courtesy J. H. McGregor.

The positions of the ears were obvious from the ear openings in the skull, but nothing else was definitely known. We have the best of reasons, however, to believe that they were quite normal human ears and they were so shown. The nasal openings of this and other Neanderthal skulls indicate a wide nose, but just how wide we cannot be sure, and the nasal bones a prominent one, not flat at all, as others had believed.

He studied the eyes most carefully. The skull had very large eye sockets, but he found that human eyeballs were fairly uniform in size, however big the sockets might be. He also found that normal eyes are placed just a little above and outside the centers of their sockets, but that they varied nearly half an inch in their prominence. He adopted the average position. But, of course, that did not fill the socket, so he worked in tear glands, muscles and eye lids to fit and thus built up the eye as it probably appeared.

All this done, he made three plaster casts for permanent records. The first was just plain and bald-headed, suitable for scientific study of the head shape. The second was also for scientific use, the right half being clothed in flesh, as it were, and the left half having this covering removed to reveal the underlying groundwork of skull eyes, nose and major muscles. But for the general public it had to be made presentable, so hair was added, a suggestion of beard and some human wrinkles. He finally touched up the eyes a bit and stood face to face with the adult male of the extinct Homo neanderthalensis. (See front cover).

But there is a whole row of these reconstructions. That row demanded three trips to Europe to examine the originals and make suitable casts and five years of exacting scientific labor. It consists of (1) the ape-man of Java, Pithecanthropus erectus, of whom there are but scanty remains and therefore more guesswork; (2) the Piltdown man, Eoanthropus dawsoni, whose skull and jaw were fairly complete; (3) Homo Neanderthalensis, whom we have watched him reconstruct; and (4) the noble-looking Cro-Magnon man, quite modern in aspect, whose reconstruction from the excellent fossil remains Dr. McGregor found too easy to be interesting. I am much afraid, however, that his "easy" misleads, for even this last demanded such scientific care and months of painstaking work that most of us would call it a "big job".



Busts of four races of Ancient Man, modeled by Dr. McGregor. 1. Ape-man of Java; 2. Piltdown Man; 3. Neanderthal Man; 4. Cro-Magnon Man. They represent *various branches, rather than a* single ancestral series. of the human family.

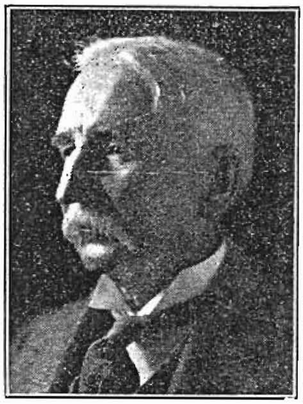
This is the first of a series of articles by various authors on "Scientists at Work", to give the layman some idea of the painstaking labors on which modern scientific conclusions are based.

The Animals of the Past

By Frederick A. Lucas, *Honorary Director, American Museum of Natural History*

THE object of these articles is to tell some of the interesting facts about the better known and more remarkable of the extinct inhabitants of the ancient world and to ease the strain on these venerable creatures caused by stretching them so often beyond their due proportions.

The author expects to be taken to task for the use of scientific names, but people who call for easier names should reflect that such names are no harder than others, simply less familiar, and when domesticated, cease to be hard; witness mammoth, elephant, rhinoceros, giraffe and boa constrictor. Again, one just must use the scientific names for the periods in which these animals lived—Jurassic, Eocene, Pliocene—because there is no other way to do it.



Dr. Frederick A. Lucas
Courtesy S. Ichikawa

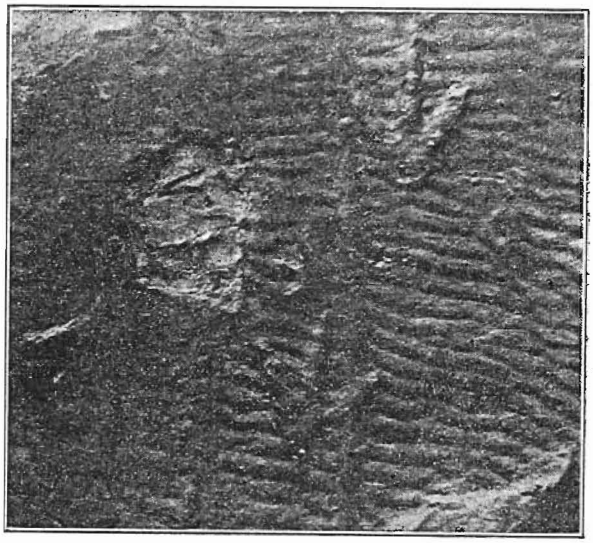
The restorations of extinct animals are according to our best knowledge and may be considered as accurate as it is possible to make them. The cuts are largely from the rich collection of the American Museum of Natural History which contains more complete specimens of fossil vertebrates than does any other.

I. How Fossils Are Formed

Fossils are the remains or indications of animals or plants that have, through natural agencies, been buried in the earth and preserved for long periods of time. It is not essential that the organic matter be replaced by some mineral to be classed as a fossil, for the Siberian Mammoths, found entombed in ice, are very properly called fossils, although the flesh of one was so fresh that it was eaten. Many fossils, however, merit the name "petrifications" because they have changed into stone by the slow removal of the organic matter and its replacement by some mineral, usually silica or lime. It is also necessary to include "indications of animals and plants" in our definition because we sometimes learn most from mere impressions, such as those of leaves, made in soft mud or smooth sand which later hardened into enduring stone. Such, too, are ripple marks and imprints by raindrops, the trails of creeping and crawling things, casts of worm burrows, footprints of reptiles. Fine mud, now become rock rivalling porcelain in texture, may bear the imprint of a bird's feathers, of a reptile's skin, of each fin ray and every thread-like bone of a fish, or perhaps such soft, delicate objects as jelly fishes. Without some of these, we might have little positive knowledge of the outward appearance of many animals of the past.

The reader may wonder why fossils are not more abundant; why not a trace remains of the vast majority of the animals that have lived upon the earth. The answer is that, unless conditions were such as to preserve at least the hard parts from immediate decay, there was small possibility of an animal being fossilized. The object must be protected from the air and practically the only way this happens in nature is by being covered with water or buried in wet ground. If a bone lies exposed to sun and rain, frost and snow, these destructive agencies soon reduce it to powder. Even in a dry climate, mere changes in temperature, by producing expansion and contraction, soon cause a bone to crack and crumble. Carnivorous animals, such as our dogs or hyenas, are great bone destroyers, as are rats, mice and other small rodents that attack bones for the grease they contain or just to exercise their teeth. Plant rootlets also enter the bone fissures, expand as they grow and thus act as little wedges to force it asunder.

If the body sinks to the muddy bottom of a lake or is caught in the sandy shoals of a river, the chances are good that its bones will be preserved. The chances are poorer in the ocean, for the waves pound them to pieces with stones or scour them away with sand, while marine worms and starfishes pierce and cut them. There are more enemies of a bone than one would imagine. But in a quiet lake, the fine mud settles gently as dew on grass. Little by little the bones are covered by a deposit that fills and preserves each groove and pore, and eventually buries them as deep as you please. Engulfment in quicksand is perhaps the best way of all, for the body is then supported without crushing. At least two examples of the dinosaur Trachodon have been found with the bones all in place, the thigh bones in their sockets and the ossified tendons running along the backbone as they did in life.



Tracks of Dinosaur feet and dragging tail across ripple marked sand, turned to stone.
Courtesy Am. Museum Nat. Hist.

If the land gradually sinks—the earth crust is ever rising and falling—the mud and sand can accumulate until an enormously thick layer is formed. The lime or silica contained in the water would tend to cement the particles into a solid mass, aided by the pressure of the overlying sediments and by the heat resulting from that pressure and derived from the earth beneath. Meanwhile the animal matter will disappear and be replaced by lime or silica, thus forming a layer of rock containing fossils. The very rocks themselves may consist largely of fossils, chalk, for example, being mostly the disintegrated shells of simple marine animals called foraminifers.

Even after an object has been fossilized, it is far from certain that it will remain in good condition until found, while the chance of being found is exceedingly small. Only here and there has nature made the contents of the rocks accessible by turning the strata on edge, heaving them up into cliffs or furrowing them into valleys. A vast number of the pages of the fossil record must ever remain unread. The wonder is that we have learned so much, for nature is careless in keeping the records—preserving only scattered fragments and then subjecting them to many accidents. Some get badly flattened by the weight of subsequently deposited strata, others are cracked and twisted by movements of upheaval or subsidence, and if at last they are brought to the surface, the same sun and rain, frost and snow, from which they once escaped, are ready to renew the attack and crumble even the hard stone to dust. That, briefly, is why fossils are not more plentiful, why we have mere hints of the existence of many animals and why myriads of creatures may have flourished and passed away without leaving behind so much as a trace of their presence.

Brains—How Come?

By ALLAN STRONG BROMS

MAN heads the class in brain power because he got the lucky breaks. That pre-monkey ancestor who took to the trees did him a couple of good turns. For one thing, he developed the skilful hands to help man's brain do its stuff. We have already discussed that. Also, his tree life made his eyes over into the best of all guides by giving them a new power. That was a second big boost. But that is really the end of this story and we must begin at its beginning.

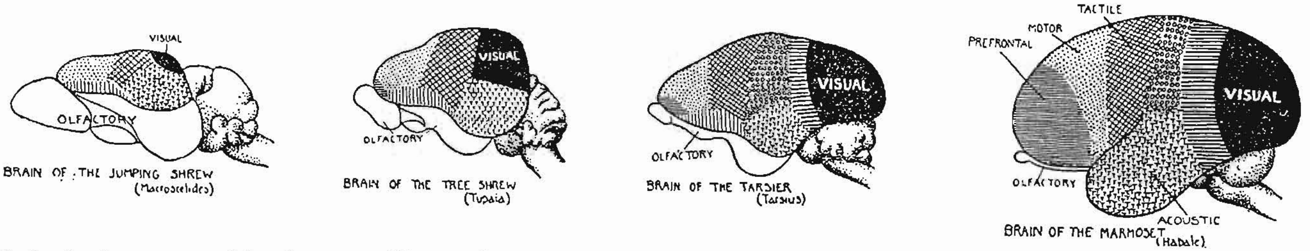
Man's earlier ancestors smelled their way through life. Some had sharp eyes, but for learning the really vital things they used their noses. Smell, and its kindred sense taste, told all that was important about food. Smell distinguished friends from enemies, sexual mates from sexual rivals. Food or poison? Friend or enemy? Mate or rival? Those are vital problems of animal life. And the animal nose knows.

But smell tells nothing of direction, form and several other details. The eyes do that. The warning sniff of danger that brings a deer up alert probably comes down the wind, but the deer never can tell for sure until it sees. Nor does it know whether the enemy scent means a harmless passer-by or a stalking hunter, until it sees. "Safety first" might seem to dictate, "Beat it while the beating is good," but the question, "Which way?" makes it best to "stop, look and listen." One look tells which way, the definite guiding fact to which can be fitted a definite, and therefore effective, course of action.

Exact and detailed knowledge comes, not through the nose, but through the eyes. And real animal intelligence arose only when the eyes supplanted the nose as the main gateway to the thinking brain. For millions of years, however, smell held sight down, for it happened that there was not room enough in the brain for both, nor on the face either. To understand this, we must take a look at the brain.

For present purposes, the brain of a back-boned animal may be divided into front-brain (top brain in monkeys and man) and rear-brain, the latter in several sections. The special job of the front-brain is gathering new information and thinking about it. The rear-brain handles nothing but old automatic routine. The front-brain *associates,* which is just high-brow for putting two and two together. It compares and chooses,—courses of action, for instance. It considers new problems, decides what to do about them and then orders the muscles to do the work.

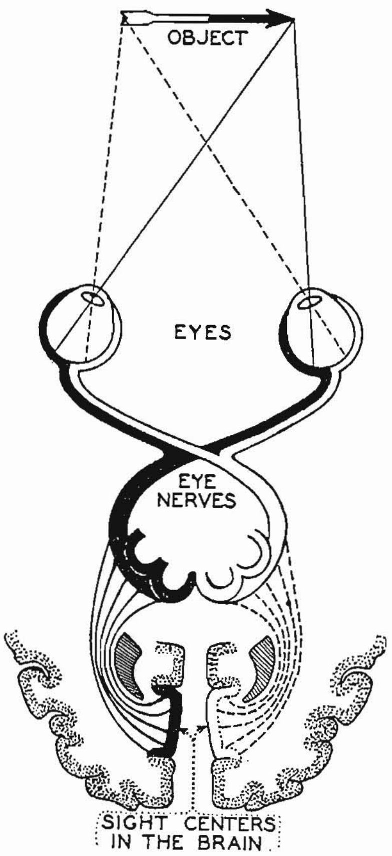
The rear-brain does not think; it just acts, and always in the old, routine ways. But if circumstances change,


VISUAL
OLFACTORY
BRAIN OF THE JUMPING SHREW (Macroscelides)
VISUAL
OLFACTORY
BRAIN OF THE TREE SHREW (Tupaia)
VISUAL
OLFACTORY
BRAIN OF THE TARSIER (Tarsius)
TACTILE
MOTOR
PREFRONTAL
VISUAL
OLFACTORY
ACOUSTIC
BRAIN OF THE MARMOSET (Hapale)

Brain development resulting from tree life. 1. Ground dwelling Jumping Shrew guided by smell (olfactory); 2. Tree Shrew guided more by vision, less by smell; 3. Pre-monkey Tarsius, sees one object with both eyes, but not stereoscopically; 4. Marmoset, our lowest monkey, sees stereoscopically, its large perfrontel area controlling eye convergence and muscular accord.

From G. Elliot Smith.

the old ways may be all wrong. Then new ways must be thought out. That is the front-brain's job. It can do the job well only if it gets exact facts to work on. As the eye gets better facts than the nose, the thinking front-brain never could amount to much until it used eye-facts instead of nose-facts. It just had to quit being led around by the nose.



Mechanism of stereoscopic vision. By branching and crossing of eye-nerves, each half of brain sees through corresponding halves of both eyes.

Drawing after J. R. Angell.

So it was really tough luck that the eye nerves of the lower animals always got the wrong connections. In the fishes and frogs, they connected with the rear-brain which could not think, and in the reptiles and birds with a part of the front-brain that was cramped and could not grow. But at last, in the mammals, they plugged in on the right switchboard and then things began to happen. For good connections do count,—especially in evolving brains.

Before this, the nose nerves always had the best connections and dominated front-brain thinking—what little there was of it. There could not be much, for the nose was a poor provider of exact facts. But though the nose-facts were not exact, they were really very important, —about the things one could smell—food, friends and foes, mates and rivals. At first, there was a good reason for the nose getting and keeping the best brain connections. The eyes just had to wait for their big chance.

There was a second reason. The eyes were not yet good enough. Eyes, to help much, must be really good, and the first ones were pretty crude. They probably only distinguished light from darkness, movement from stillness, without telling anything about color, shape and distance. To develop them took time. So the nose got there first and took over the front-brain job, with the eyes as mere helpers.

In the reptiles and birds, the eyes got a first, slim chance. In helping out the smell sense with stray bits of exact knowledge (which worked into the front-brain associations), the eye nerves got a foothold in the front-brain. But unluckily they got into a crowded spot, underneath and inside where real growth was impossible. So nothing much came of it until one of the reptiles evolved into a mammal.

Among the mammal improvements was the connecting of the eye-nerves with the roomy outside of the front-brain. That helped a lot. The eye-facts, because they were more exact and useful in thinking, gradually displaced the nose-facts as rulers over the front-brain. New associations, dominated by sight sensations, were acquired, and the front-brain grew a lot of new nerve connections in its complicated switchboard. Of course, the new sight-center grew. But so did other centers too, of muscle control, of touch, of association, because clear seeing helped them do their jobs. Only the smell centers (olfactory lobes, etc.) dwindled. In man they have completely lost their dominating importance. Today we are predominantly eye-minded.

In the very highest mammals an additional eye-power developed,—stereoscopic vision,—seeing an object as a solid by viewing it with both eyes at once. It works like the old-time stereoscope that made two flat pictures stand out as solid objects. In most animals, the eyes work separately and can watch on both sides. In man and his recent ancestors, the two eyes look at the one object, converging (sort of cross-eyed) to do it. The closer the object, the more they converge. Our feeling of the convergence then tells us the distance. Try it. Close one eye and try to thread a needle. Open it again and note how it brings out distance. Your tree climbing ancestor, swinging and leaping from branch to branch, had to know his distances, for a miss was as bad as a mile. He needed a quick and accurate range-finder, and the new eye-power was just that.

To do this stereoscopic trick, the eyes needed new brain connections. For one thing, they had to move accurately together and this required better accord in muscular control. But something even more fundamental had to change. Before this, each hemisphere (side half) of the brain connected with just one eye and the two images entering through the two eyes had no common brain center in which to blend into one image. With the new eye-power, each hemisphere connects with the corresponding halves of *both eyes.* Each half of the brain therefore sees through both eyes, and the two images merge and become one to the mind. That one image now has, besides height and width, also depth (distance). It appears in three dimensions, looks solid and stands out. You can distinguish substance from shadow. That helps skilful handling and clear thinking.

Also some changes had to be made outside on the face. The eyes had to be right out front where they could both see the one object at one time. That meant that the big snout for smelling had to go, for it interfered with the view. To your tree-dwelling ancestor this loss did not matter, for he no longer tracked his prey by nosing out the smells they left along the ground, and from his high outlook he could see danger as easily as he could smell it. With eyes front and snout reduced, his face began to have the human look. Best of all, peering out through those knowing eyes was a growing mind, dominated by clear vision and muscular mastery. It took millions of years to develop, but it was worth it. For it gave man his lead on the animal world and made him the big boss on earth.

But to win man needed also touch and muscle control, hearing and sense of balance. Some of the story of how they grew up together will be told in our next.

EVOLUTION

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WE GREET THE R. P. A.

Through the kind co-operation of the Board of Directors of the Rationalist Press Association in London this issue of EVOLUTION is being sent to their entire membership throughout the world.

This may seem like "carrying coals to Newcastle," for certainly every member of this progressive organization is already an evolutionist and emancipated from religious superstition. And EVOLUTION is not published primarily for the entertainment or information of those that are convinced evolutionists. But EVOLUTION offers itself as an instrument for evolutionists to use in their work of enlightening their friends and neighbors. We hope that all English-speaking Rationalists will find it a useful weapon in their fight against intolerance and fanaticism no matter where they live.

Although bred of bigotry in the United States, the World's Christian Fundamentals Association has the avowed purpose to suppress in the entire world all teaching of science that conflicts with the Bible story of creation. Rationalists everywhere will surely gird their loins to help beat back this renewed attack of preacher upon teacher.

Two friends of intellectual freedom have made this world-wide mailing of samples of EVOLUTION possible through their generous contributions. Frank Gosling of England covers the postage costs, and A. Nielen of the United States paid for the three thousand copies. We invite others to follow their splendid example and furnish enough funds to make EVOLUTION a real power, able to cope with militant fundamentalism and help win the world for the Open Mind.

AN OVERSIGHT

The American Museum of Natural History should have been credited with the illustration "Comparative sizes of living and extinct Proboscidea" used on page6 of our August issue.

TWENTY STATES TO VOTE ON EVOLUTION

There is a tendency to look upon the Arkansas anti-evolution referendum as merely an evidence of local backwardness. Few realize that in Arkansas there is taking place the opening skirmish of a tremendous campaign that has been planned far in advance by the fundamentalist generals.

They have already announced their intention to place this question on the ballot in every one of the twenty States that have Initiative laws. That means: Arkansas, Arizona, Idaho, Maine, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, North Dakota, Ohio, Oklahoma, Oregon, South Dakota, Utah, Washington, California and Colorado.

Maynard Shipley, President of the Science League, writes: "Watch Oklahoma. If Arkansas goes anti-evolution in November, Oklahoma will be next. Straton is out there now, also Brown and others of the 'flying squadron'."

The only way to meet this fundamentalist menace is POPULAR ENLIGHTENMENT. In this EVOLUTION hopes to serve, and invites your immediate co-operation.

THEY'D CALL A SPADE A SPOON

The most preposterous pretense put forth by fundamentalists is that they favor "separation of church and state", and that they oppose evolution because it is a "religion", and they "do not want religion taught in the schools." This is like calling a spade a "spoon."

The fact is that the passing of an anti-evolution law immediately takes control of the class-room out of the hands of the teachers and puts it in the hands of the local preachers.

A fundamentalist apologist, Eugene McSweeney, writing in their official organ, says: "The Anti-evolution law is nothing more than a modern application of the ancient law of blasphemy. It merely says to the teacher, 'You shall not deny the story of God's creation in the class-room, because it alienates the students from the love of and reverence of God.'"

Exactly. And who would be the official snoopers to ferret out teachers under this "modern application of the ancient law of blasphemy"? Who but the pulpiteers? And woe unto the teacher who doesn't toe THEIR mark.

Do the folks in Arkansas really want to make their schools mere annexes to their churches? Then pass the anti-evolution law.

JUST A SUGGESTION

If the preachers are to tell the teachers what they may and may not teach regarding natural science, shouldn't they be required to have at least a little bit of scientific training? Is it fair to force the teacher to pass a stiff examination before being allowed to teach science, and require nothing of the preacher? Why shouldn't the parson have to pass similar examination under the Department of Education, or else keep his mouth shut?

PARSON VS. PEDAGOG

The clergy have always claimed the right to control education. The schoolmasters have always resisted the claim. There is an irreconcilable difference, a three hundreds years' war that may well keep going three hundred years more, that most probably will keep going in some form so long as both parsons and pedagogs remain on the earth.

For the ideals of pedagog and parson must always, of necessity, be in conflict. The teacher's duty is to make his pupils think; and to this end he acquaints them with just as wide a range of ideas and principles and facts and theories and points of view as, in his professional judgment, they are capable of utilizing at each stage in their development. With their opinions he has no concern. His duty is done when his pupils understand the nature of each possible opinion and the reasons for accepting or rejecting it.

Not so the clergyman. His professional duty is to make his parishoners believe; and to this end, quite rightly, he strives to limit their range of ideas, principles, facts, theories, and points of view; for he knows, again correctly, that belief results from narrowing the mind, not from expanding it. Unlike the teacher, he is responsible for people's opinions, and he takes an obvious method of controlling them. So the man who wants people to think, and the man who wants to keep people from thinking, have to fight out or compromise a difference that they cannot adjust.—From address of Edwin Tenney Brewster before Rationalist Society of Boston published in The Truthseeker.

STORY BY McKECHNIE

In our next issue will begin an entrancing story by H. N. McKechnie, author of "Heir of All the Ages," entitled "Twigs from the Family Tree," and explaining in fiction form how our ancestors may have branched off from those of the apes.

UNDERMINING OUR EDUCATIONAL SYSTEM

By OSCAR O. WHITENACK

(*Extracts from leaflet issued by Colorado Rationalist Association*)

EXAMINATION of a few fundamentalist propositions will show the quality of their teaching and its effect on our educational system.

They say: "There is not a shred of evidence for evolution." But Sir Arthur Keith, standing before the British Association for the Advancement of Science last year, declared: "The evidence of man's evolution from an ape-like being, obtained from the study of fossilized remains, is definite and irrefutable." And no ta scientist in his audience nor in all Europe and America QUESTIONED THAT STATEMENT.

They say: "Man has existed but a few thousand years. He could not have lived through the ice-age of ten thousand years go." Every anthropologist, every encyclopedia and our textbooks all assert that man has been on earth not less than 500,000 years and the evidence that he did live through MORE THAN ONE ICE-AGE IS IRREFUTABLE. See "Men of the Old Stone Age," by Osborn.)

"The Old Stone Age, the New Stone Age and the Age of Metals were not successive but contemporaneous." This contradicts every authority in anthropology and simply ignores the evidence of the remains of primitive man. (See Dr. McCurdy's "Human Origins.")

"The Flood of Noah is historical. There is a flood story in the traditions of every people." Both statements are false and any man in the twentieth century who thinks that Noah's Flood is historical ought to be ashamed of himself. The Encyclopedia Biblica, the standard authority of the Church, declares that the Deluge story is but a myth. All other encyclopedias agree. The history of Egypt begins 4241 B. C. and her traditions go thousands of years back of that date and there is no mention of a Deluge. (History of the Warfare of Science with Theology, by White.)

"The tremendous catastrophe (The Deluge) accounts for all the sedimentary strata which we find all over the earth, and is the cause of practically all the great mountain systems of the world. Waves rushed around the earth every twenty-four hours at a rate of more than a thousand miles per hour, and they must have been six miles high." Can anyone imagine stratified rock a mile thick laid down in the first six months of the Flood and the Grand Canon of the Colorado being cut in the next six months? Imagine the Alps, the Andes and the Rockies being formed in the one year of the Deluge? Imagine Noah and the menagerie in the Ark safely riding these six-mile-high waves moving at the rate of over sixteen miles per minute? IS THIS THE "SCIENCE" THEY WANT TAUGHT IN HIGH SCHOOLS INSTEAD OF GEOLOGY?

It is not my purpose to heap ridicule upon their heads. If the fundamentalist "message" is true, our leading scientists are little more than charlatans and poltroons. If they are right we should revise our courses of study, delete our libraries of all works on Geology, Anthropology, Biology, etc., etc., rewrite our histories and encyclopedias, hold in utter contempt Darwin, Osborn, Wallace, McCabe, Sir Arthur Keith, McCurdy, and thousands of others, wipe out the results of the researches of the past century, declare to the world: "Fundamentalists hold the truth, the whole truth, and nothing but the truth" and STOP ALL RESEARCH.

Indeed, SUCH A MOVE IS POSSIBLE and in Mississippi and Tennessee it is actually carried out. Children by the millions are being LEGALLY RETARDED IN THEIR MENTAL AND MORAL DEVELOPMENT—and at the instigation of religious leaders! All scientific facts that contradict the fundamentalist interpretation of Genesis are taboo. Teachers, highly trained in Science and History, must take orders from the ignorant clergy as to what they shall teach, or lose their positions. AND THE SAME CONDITIONS PREVAIL IN MANY LOCALITIES IN OTHER STATES.

But the greatest menace in the program of the Fundamentalists is their method of teaching. Not one of their preachers would open even the church basement to Maynard Shipley, David Starr Jordan, Joseph McCabe or to Sir Arthur Keith. In denying a hearing to their opponents, in prohibiting by law the teaching of evolution, they ASSUME THEY HAVE A MONOPOLY OF THE TRUTH. Did not this very assumption cause the execution of Socrates, the Crucifixion of Jesus, the burning of Bruno, and the damnable humiliation of poor old Galileo? Has it not caused more suffering, more hindrance to progress, than any idea that ever cursed the human race? And will it not wreck our educational system completely wherever it is put into practice?

Frogs Without Fathers

By Joseph McCabe

A COUPLE of centuries ago, when science first discovered the existence of germ cells, even the scientific imagination ran riot in speculating about them. Here was a minute bit of jelly which, given time and the proper conditions, would build up the entire and marvelous structure of a bird, a lion or a man. How? Well, the first idea was that each of these germs was a properly formed body (of a bird, lion, man, and etc.) in miniature. The tiny human ovum, less than the hundredth of an inch in diameter, was supposed to be a fully formed body, with face, heart, nerves, muscles, etc. It merely grew bigger in what we called its embryonic development. If that is so, the whole race must have been packed away, in very small miniature, in the body of Mother Eve. Indeed, one famous scientist, working on the good old theory that she trod the earth and ate apples six thousand years ago, startled his contemporaries by estimating that Eve had inside her no less than two hundred billion miniature humans. . . . It sounds funny today, but recollect, on the other hand, that for the previous five thousand years of civilization men had been totally ignorant of the very existence of germ-cells. They knew little more about one of the most wonderful phenomena in the world, the formation of a new body, than a child does.

When the microscope became more powerful, and it was seen that the body was only gradually formed, the question of the respective shares of male and female became very intriguing, especially in view of the scores of cases in which the male did not co-operate.

For the experimental embryologist animals of the star-fish and sea-urchin type are the most convenient. He easily secures a few ova, as we insist on calling them in this "vulgar age" of ours, instead of using the English word "eggs," which seems to hurt people's feelings, and bring the dark lanterns of the police upon you. These microscopic ova are then put in sea-water under a lens, and you can follow the whole wonderful story of the construction of the very elaborate body of a star-fish from the tiny speck of plasm. If there are both male and female elements in the water, you find the tadpole-like male elements wriggling about until one gets, by chance, near the ovum. Then some evacuation from the ovum, akin to smell, seems to attract it—here I am giving you a mere supposition—and at all events it moves in toward the ovum. The next step is curious. There is a jelly-like substance surrounding the ovum, and through this it sends out a sort of filament toward the male particle: for all the world as if it were fishing for it. The male, in fact, seems reluctant to be drawn in, and often the tail lashes more vigorously and it breaks away again. Normally it enters or is drawn into the ovum, and the first steps in the formation of a new organism soon follow.

Loeb and others, watching these sea-urchin elements under the microscope, noticed that if the tadpole-like male cell touched the ovum and got away again, the ovum began to change just as if it were fertilized. This gave them the idea of touching it with a needle. You want some skill to touch a little globule of jelly about the two-hundredth of an inch in diameter—that is to say, far smaller than the dot on this i—with the point of a needle, but the resources of a modern laboratory can meet more exacting requirements than that. It was done, and we found the ovum began to develop.

Meantime it was found that altering the condition of the sea-water in which the germ cells floated could bring about the same result. If the quantity of salt in the water is greatly increased, the ovum, without fertilization, begins to develop. Neither the simple prick of a needle nor the strong solution of salt will make it develop into a fully formed animal, but experiments were multiplied by the thousand until acids were discovered to bring about the desired result. The pricked ovum in a certain medium without the needle, made the male superfluous, and all kinds of animals, up to the level of the frog and the newt, came into the world sinless and fatherless. You may ask why we stop at the frog. Why not open out the prospect. . . . There is no need to run on to speculations of this nature. On reflection you will understand a very good reason why the experiment stops at the frog. It is the highest animal in the world which leaves its ova floating in the water. It is not so easy to try such experiments on land animals.

O. B. U. Bulletin.

How The War On Fundamentalism Began

By Harry Elmer Barnes

A MOST striking phase of cultural progress from 1500 to 1800 was the development of natural science from Copernicus to Newton and Lavoisier. This put at man's disposal a vast new knowledge of the physical universe, the nature and processes involved in the life of man, and the relationship between man and the other animals. It also emphasized the new scientific or inductive method of searching for truth as opposed to the older religious and metaphysical technique. At first this scientific approach was confined to the physical and biological sciences, but its success there made its ultimate application to man and his social relationships inevitable. By undermining the views of man resting upon the religious outlook, it encouraged the study of man simply as a human being in a secular setting. The discoveries overseas helped this scientific movement by stimulating the spirit of curiosity and by bringing information about the physical universe as observed from new angles, the flora and fauna of the world, new rocks and chemicals, geographic conditions, and, above all, the customs of man in all parts of the planet and in all stages of cultural evolution.

A group of English Rationalists were the first to utilize this new knowledge for the reconstruction of the prevailing view of the world, God, man and society. Lord Herbert of Cherbury (d. 1648) and Charles Blount (d. 1693) formulated a new, Deistic, religion based upon reason and alleged to have been found in all essential phases among all peoples at all times. This religion rested upon five fundamental tenets: (1) the existence of God; (2) the worship of God; (3) the view that the promotion of better living was the chief end of worship; (4) the contention that better living must be preceded by the repentance of sins; and (5) the belief in a world to come in which man would be dealt with in accordance with his daily life here on earth. It was justified with the assertion that it was universal, while Christianity had been defended upon the contention that it was unique.

Alexander Pope in his *Universal Prayer* (1737) developed a conception of the physical universe and of God compatible with the new astronomy and natural science. The petty God of the ancient Hebrews was manifestly not adequate to serve as ruler of the new universe revealed by the astronomers from Copernicus to Newton. God had to be magnified to create a supernatural being suitable to the new cosmic perspective. Further, the Christian notion of God had been one of arbitrariness. God, to the Christian, was functioning vividly only when leading nature to deviate from her normal course in earthquakes, volcanic eruptions, tidal waves, comets and the like. Pope and his associates were impressed with the processes revealed by natural science and came to regard God as a law-making and law-abiding God. He was especially manifest in the unending repetitions and orderly behavior of nature. Natural law was identified with divine law, God being regarded as the source of all natural manifestations.

The Third Earl of Shaftesbury made another contribution to the reconstruction of God. The Hebrew and Christian God was arbitrary, jealous, inconsistent, cruel, revengeful; as Mark Twain remarked, guilty himself of all the sins and crimes for which he punished mankind. The gentle Shaftesbury was repelled by all this. Montaigne had earlier protested against the orthodox slanders of God, holding that God had more majestic and Godlike responsibilities than counting the hairs on the head of each individual daily or taking a census of the sparrows at nightfall, and that divine activities were on a divine level and of a divine character. Shaftesbury went further. He held that, while the attributes of God probably far transcended the human imagination, we could at least credit God with the urbanity and decency possessed by a cultivated English gentleman of the year 1700. He is often described as the first man to discover that God is a gentleman. The net result, then, of Deism and Rationalism was greatly to magnify and dignify the conception of God. Of course, the orthodox of that age regarded these writers as atheists. Most of them, however, including Voltaire, believed in the new Deistic God.

David Hume suggested that religion be studied in a realistic fashion by psychological methods as one would any other phase of human behavior. Hobbes, Spinoza and Astruc laid the foundations for biblical criticism. In this way orthodoxy was directly undermined at its very source and indirectly through the accumulation of scientific knowledge that challenged the scientific views embodied in the Bible. Matthew Tindal, Thomas Chubb and Henry St. John Bolingbroke drew a sharp contrast between "true" and "historic" Christianity. True Christianity was made up of the teachings of Jesus. Historic Christianity was the religion of the Catholics and Protestants of the seventeenth and eighteenth centuries, bearing only the most remote resemblance to the teachings of Jesus. These Deists accepted true Christianity as a valid religion according to the five basic tests, but rejected historic Christianity. Conyers Middleton, in his *Letter from Rome* (1729), pointed out the large number of pagan elements in historical Christianity. Gibbon explained the triumph of early Christianity as the result of secular historical causes rather than divine intervention. Middleton pointed out the unreliability of the Christian Fathers as historians. He showed that theirs was a credulous age, given to forgery and miracle-mongering, however high the motives of the faithful. Woolston, Middleton and Hume offered withering criticisms of the Christian belief in miracles. Hume's arguments have probably never been surpassed and may be regarded as the definite refutation of miracle-working and its services to the faithful.

There were also important social implications of these views. Shaftesbury suggested that the aesthetic basis of morality was sounder than the theological, rejected the orthodox notion that that was moral which led one safely into the New Jerusalem, and contended that the true test of the moral act was its contribution to the true and the beautiful. He was a Greek among the Puritans. Pope attacked the conventional Christian tendency to degrade man to a vile entity unworthy of study. The Deists upheld man as the supreme achievement of God's creative ingenuity and contended that to depreciate man was to insult God.

By thus rehabilitating man in his mundane setting, as he had not been since Greek days, the Deists aided the rise of the social sciences devoted to the study of man's nature and social relationships. Hitherto only theology had been regarded as significant because only man's soul was important. Inevitably with increasing interest in man as man came the desire to increase human happiness by improving social conditions and eliminating abuses and oppression. Thus secularism immediately suggested reforms in institutions, of no interest to a logical, orthodox, Christian, since he was chiefly concerned with salvation and, in any event, expected material things to pass away fairly soon. This interest in reform was well expressed by Helvetius, Condorcet and Bentham. The whole Rationalist philosophy was best summarized by Thomas Paine, organizer and expositor of high order, and noble crusader for truth and justice.

While this Rationalist movement began in England, it soon gained headway on the continent. Voltaire visited England in his earlier years and became the greatest exponent of the philosophy of freedom and enlightenment because of his versatility, courage and zeal. Diderot and the Encyclopedists first systematized, classified and rendered available to the reading public the essentials of the new learning and new Rationalist philosophy.

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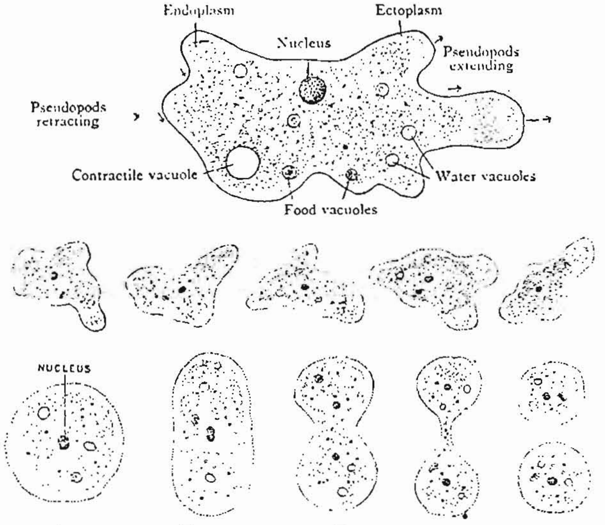
The Amateur Scientist

A Monthly Feature *conducted by* Allan Strong Broms

AMOEBA, THE ONE-CELLED

Amoeba, one of the simplest of all animals, consists of a single, shapeless cell and is therefore microscopic in size. It should be looked for in the slimy coatings of leaves or stems submerged in stagnant water or on the slimy ooze of the bottom mud. Of course, a drop must be placed on the microscope slide and a cover glass placed gently over it. Then comes the real job of finding it, for its slowness of movement and lack of definite shape make it easy to miss. It is just a speck of clear, colorless jelly with a delicate, yet distinct outline. Within it appears a denser nucleus and occasionally a clear space, the contractile vacuole.



Amoeba; its structure, changes in shape, and method of reproduction by division.

If the object under suspicion is really an amoeba, it will presently betray itself by moving. One side will bulge into a projection called a pseudopod (false foot) or perhaps several of them. The pseudopod may be retracted, but often the rest of the body flows into it, resulting in locomotion, often in a consistent direction.

If a food particle happens in the way, a pseudopod extends to engulf it, usually with a little water. The space thus occupied is called a food vacuole and slowly disappears as the food is digested and absorbed. Waste matter is merely left behind as the amoeba flows away. The whole or any part of the body acts as stomach, while the surface in all its parts serves as mouth, lungs or excretory organ as occasion demands. It also seems to have a sense of touch, for it often avoids obstacles in its way, though this may be simply a chemical reaction of its jelly stuff.

When well fed, the amoeba may reproduce by simply dividing into two. Its middle becomes constricted, the nucleus divides and the constriction increases until the two halves part, each a complete amoeba. On the other hand, when subjected to drought or other unfavorable conditions, it forms a tough outer wall or cyst and remains dormant. When favorable conditions return, it ruptures the cyst, crawls out and renews its sluggish life. Our first ancestors must have resembled amoeba.

THE FALLING LEAVES

The leaves are turning to autumn tints and falling. That is the plant's way of saving the green stuff which gives it life. This green stuff, called chlorophyll, when exposed to sunlight stores away the energy of the light in the food materials which it builds up out of such substances as water, gases and soil material.

The cold of winter will stop the flow of the plant sap which carries the supply of materials and the food to and from the leaves. It is therefore an economy to withdraw the valuable chlorophyll from the exposed leaves before the frost begins to bite and kill. So it is withdrawn well into the body of the tree. The leaves thus lose their green and the reds and yellows now appear to glorify our landscapes.

When the withdrawal is completed, a thin layer of cork appears between the base of the leaf stem and the woody branch. This seals the wound that would otherwise be left when the leaf falls. Next spring, when the sap begins to flow once more, the new leaves bud out, green with the life-giving chlorophyll that has been saved, to do their work of food manufacture. Trees that use this method of shedding their leaves each year are called deciduous.

The evergreen trees have found a different solution by forming fat, needle shaped leaves which do not freeze so easily because they have less surface exposed. These do not fall off seasonally, but do their work on every day that is warm enough. As they usually live in a cold climate or at high elevations where spring comes late and winter early, each day of warmth and sunshine must be used, with no time for getting ready by growing new leaves.

Each method has been evolved by the survival of those plants that varied to fit these differing conditions of their surroundings. Those that did not fit, died out, while those that did fit, lived on and spread their kind.

"Faith," said the little boy, "is the power of believin' things you know aint so."

POPULAR ASTRONOMY LECTURES

New York City readers should attend the popular lectures given by the Amateur Astronomers Association at the American Museum of Natural History at 8:15 P. M. on the first and third Wednesdays of each month. The next, October 17th, is by Dr. H. T. Stetson of the Howard College Observatory on the subject, "What of Sun Spots."

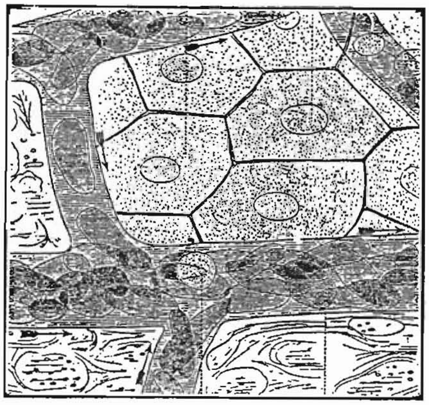
CIRCULATION OF THE BLOOD

The circulation of the blood can be seen in the thin web of a frog's foot. One with a pale web is best. The frog should be wrapped in a wet cloth, with one leg projecting, and then tied to a piece of shingle. Cut a hole in the shingle under the frog's foot. Tie threads around two of the toes and stretch the web, not too tightly, over the hole.

Now put the stretched web under a low power of the microscope. The large tubes are arteries which subdivide into a network of fine capillaries which then join into veins. The capillaries receive the blood from the arteries and pass it on to the veins. The pulsing streams of blood can be clearly seen, particularly in the arteries.

Under a high power, the large oval and slightly colored corpuscles are individually visible as they rush past. They are the boats of the blood stream carrying food matter and oxygen to the body tissues and carrying away the wastes. There are also other corpuscles, smaller, rounder and paler, fewer in numbers and moving slowly and unsteadily along the sides of the tubes, the so-called white corpuscles. One of their important jobs is to protect the body against disease microbes.

To examine the corpuscles more clearly, they must be stopped. The easiest way is to place a drop of the frog's blood on a microscope slide, with a thin cover glass over it, and examine it with a very high power. You can do the same thing with a drop of your own blood. The comparison is very interesting. When you have had a good look, unwrap the frog and let him go. He has contributed his share; give him a chance.



Fine blood vessels in frog's foot, showing oblong-red and round-white corpuscles. Arrows show direction of blood flow.

Funnymentals

"Every person who shall blaspheme against God, either of the persons of the Holy Trinity, the Christian religion, or the Holy Scriptures, shall be fined not more than one hundred dollars, and imprisoned in a jail not more than one year, and may also be bound to his good behavior."—Sec. 1323 General Statutes of Connecticut.

"Thou shalt not suffer a witch to live."—Exodus xxii, 18.

"If we could divide the human race into two distinct groups we might allow evolutionists to worship brutes as ancestors, but they insist on connecting all mankind with the jungle. We have a right to protect our family tree."—Wm. Jennings Bryan, in The Menace of Darwinism.

"If the brute theory leads to the abandonment of belief in a future life with its rewards and punishments, what stimulus to righteous living is offered in its place?"—Idem.

"The Great Pyramid stands as silent witness against materialistic evolution. It furnishes evidence that the first man instead of being a hairy primate just down out of the trees was the most perfect of all mere men, the most knowing and the most exalted; that the rare and special rapport with the supreme intelligence. which for certain gracious purposes was afterwards vouchsafed to the prophets, was Adam's normal condition; that the highest state of mind and heart, and such qualifications as best fitted him for his earthly life and destiny were realized in him as he came from the Creator's hand.

"No ugly, walking ape or ignorant savage, tenant of semi-tropic woods or musty caves, did God behold and bless when He set Adam in the world as the image of Himself and proclaimed him good."—Dr. Charles Spurgeon Knight, in The Defender, July, 1928.

"Books can bite; books have poisonous fangs, and American libraries may not all be known as snake museums; but the snake of infidelity and atheism is abundant in most of them."—W. B. Riley in Christian Fundamentalist, Sept., 1928.

"The first proposition that the sun is the center and does not revolve around the earth is foolish, absurd, false in theology and heretical because expressly contrary to Holy Scripture. The second proposition that the earth is not the center but revolves about the sun is absurd, foolish, false in philosophy and from a theological standpoint at least, opposed to true faith." Decision regarding Galileo by Holy Inquisition at Rome.

Send us quotations for "Funnymentals" column. Be exact. Give authority.

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FROM SCHOOLBOY SCIENCE PAPERS

The earth makes a resolution every twenty-four hours.

The difference between air and water is that air can be made wetter and water can not.

We are now masters of steam and eccentricity.

Things that are equal to each other are equal to anything else.

Gravity is chiefly noticeable in the autumn, when the apples are falling from the trees.

The axis of the earth is an imaginary line on which the earth takes its daily routine.

A parallel straight line is one which if produced to meet itself does not meet.

Electricity and lightning are of the same nature, the only difference being that lightning is often several miles long while electricity is only a few inches.

—Boston Transcript.

Noah On Evolution

By Pauline H. Dederer

On top of Mt. Ararat, old uncle Noah sat
Reading the news in the Daily Earth.
Quoth he, "Mrs. Noah, I'd just like to show a
Fool editor here what I think he is worth!

"In the dread name of science, he bids us defiance,
And calmly declares us to be but a myth
Of the old nature fakers, and history makers,
In order to give their books piquance and pith.

"Man of ape is the brother, or cousin, or other
Near relative, he says, of nobler estate,
Who lost his long tail, and grew brains to such scale
That he's now mighty proud of the shape of his pate."

Said old uncle Noah, "I think they might go a
Long way ere they found such ancestors as we,
And why they should spurn us, so meanly down-turn us,
Is more than my old eyes can possibly see.

"My grandfather Adam, the boys and the madam,
I always supposed were the first of our race;
But if 'tis a fable about Cain and Abel—
The Tower of Babel—there's nary such place.

"Do you think we were dreaming when we saw the streaming
Of flesh, fish, and fowl through the doors of our camp?
And don't you remember, one day in September,
My love, you declared that the place was TOO damp?

"This cult of the monk is just nothing but bunk—
An ape for a grand-dad—the big hairy brute!
What that man doesn't know I can very soon show,
And pull up his family tree trunk, branch and root.

"To his office we'll hump us, stir up such a rumpus
He'll make quick retracting, and grant us redress,
And I'll wager a dime that in double quick time
You'll see a fine write-up of us in the press."

From Our Readers

"We are not interested in your Evolution and infidelity nor your 'ancestors'. Send it to those who descended from the monkey."—J. D. Hammond, Beebe, Ark.

"Please rush us six copies of Evolution."—Warner Drug Co., Hoxie, Ark.

"Read your Bible first."—Arrow Variety Store, Morrilton, Ark.

"Send me some order blanks and I will get all the subscriptions I can before election as I would hate to see the fundamentalists pass their anti-evolution bill. Got these four subs in a few minutes, in fact made four sales out of five calls."—C. D. Foreman, Arkansas.

"Men, your fight has just begun. May your courage (and cash) endure. Kill the Beast!"—George Wolpert, New York.

"I find Evolution a bright, snappy sheet,—just the thing for conversion of the heathen."—C. H. Dresser, Connecticut.

"The other $1 is for the benighted in Arkansas province. Use it to send Evolution to twenty in the twilight zone, or should I have said land of the midnight sun."—Marshall Dunn, New York.

THE CHOICE

The Funnymental preacher
  Denies his monkey blood;
Wants his children's teacher
  To teach they sprang from mud!

Why should he get the dumps
  About his monkey blood;
Isn't the monkey many jumps
  Ahead of a lump of mud?

—Bob Lyle.

"Send me 30 copies. Of all that I have received, none remain in my possession, owing to their seizure by interested friends." Hymie Karshofsky, Tennessee.

"Please send complete set of Evolution and continue for the year. I already subscribe, but can't keep the copies. The second set I shall have bound." Charles W. Townsend, Massachusetts.

"Enclosed check for $10 as contribution to your educational campaign on ignorance. May your valuable work bring fruit."—M. Zametkin.

"While we are not science teachers, we are professional women with University degrees and are naturally interested to see the battle against ignorance and bigotry waged as vigorously as possible. Enclosed find check to aid in your campaign in heathen Arkansas."—Misses C. Z. and F. M. Hartman, Illinois.

"I have read with pleasure every number of Evolution and wish to compliment you on the magazine's excellent 'get-up'. It is a much needed periodical and I wish it every success." Stephen C. Preston, Oregon.

"There is a mighty field for Evolution. I look forward to its gigantic growth and success, and with all my heart I welcome it and wish for its universal spread." F. F. Berry, Calif.

"Send the splendid magazine to the five addresses. Success and best of luck." Benjamin Fine, New York.

FOR ARKANSAS EDUCATION

Since the people of Arkansas have to vote on the question of evolution November 6th, many who never bothered with such subjects before want to know what it is all about. A seed planted in this receptive ground should bear fruit. We'll plant twenty copies of EVOLUTION among Arkansas voters for every dollar that you remit "for Arkansas Education."

The following contributions have already been received: Louise W. Kneeland ,$5; Ellen R. and T. M. Nagle, $10; Frank Masek, $4; A. A. Heller, $4; Misses C. Z. and F. M. Hartman, $5; Rudolph Eickemeyer, $10; Chas. W. Townsend, $5; M. Zametkin, $10; Gustav Schmeman, $1.25; M. Dunn, $1; G. M. Morris, $2; J. U. Norris, $1; Geo. W. Van Pelt, $1; Mrs. J. O. Beebe, $5; C. H. Dresser, $3; Chas. Schuchert, $10; A Friend, $20; C. N. Clauder, $1; Ernest Lilien, $1; H. L. Gonor, $2; Czechoslovak Rationalist Federation, $10; S. W. Narregang, $2; Emil Falk, $2; Joseph Wittek, $5; B. A. Levett, $10; Chas. Fuchs, $5; Junius Henderson, $5; G. J. Johnson, $5; Herold Wuerfel, $1; Mrs. Earl Chichester, $1; H. G. Wyatt, $1; Geo. H. Childs, $1; Julius Janowitz, $10; Mrs. F. M. Lachmund, 75c; A. Marsh, $5; E. L. Sumner, $1.

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AIMEE IN ENGLAND

The Reverend Aimee Semple McPherson is now holding forth in Albert Hall in London. In view of the report that 150 cities in England have asked for her services we reprint for the consolation of our British friends the following from E. W. Howe's Monthly:

THE REVEREND
AIMEE McPHERSON.

> Every time Aimee McPherson advertises a religious meeting, and attracts a considerable audience, I blush for the race to which I belong;
>
> For all those who attend such meetings in sober earnestness, and accept what she says as important, are pitiful evidences of degeneration;
>
> I wonder that statistics of such attendance are not collected widely, printed as matters of alarm, and something done to help save these poor wretches, as we now endeavor to help other unfortunates.
>
> The McPherson woman has no intelligence, no message, no morals, and no honest way of making a living. The fact that certain persons go to such a creature for help is serious indictment of the human race.

"IF YOU do nothing to help make the world better, you help to make it worse. If you do nothing to overthrow tyranny, you assist in maintaining it. If you fail to fight for freedom, you aid in enslaving your friends. If you are not a propagandist for truth, you are a supporter of error."—Queen Silver.

HEIR OF ALL THE AGES, by N. K. McKechnie, Bobbs-Merrill Co. $3.50.

Here is a story told in reverse, the beginning last and the end first. The end is Mr. Hamilton Smith, a strap-hanger like you and me, who clerks downtown and chews gum. He is not an adventurous soul at all, but he certainly did have ancestors who got their thrills. He is not a bit proud of them, what he knows of them, but he certainly ought.

There was Wat the Wagoner who loses a night's sleep only four generations ago; then Hubert the Smith who marches to the King in the Revolt of the Peasants back in the fourteenth century. Still further back, Oswulf the Briton waif finds a kind father among the new Saxon masters of England. That was forty-five generations ago; the next is seventy-five. Conan, the Druid boy, joins the blood-feud of his Briton master to win a sweetheart and fame. Long before that, Ith the husbandman narrowly escapes death and deification that the village crops may grow. Skipping another six thousand years, we see the uncouth Hu, migrant, woo his fisher-maiden of the lake-dwellings. Long, long before that, Firestick, he of the fire magic, weathers the great Mediterranean flood when the Atlantic waters break through the Gibraltar land-bridge between Europe and Africa. An earlier ancestor was Twice-Born, lucky, though he and his kin must needs follow the great reindeer herd food-supply across the cold wastes of the Ice Age. And so on, plunging back through the hundreds of thousands and even millions of years; Fuzzy-Wuz, the lusty voiced ape-man who escapes Sabre-Tooth, the tiger; then Outcast, the man-ape, who dies a heroic death; Chat-Chat, monkey-like dweller in a tree-top paradise; little Possie, first of the mammals, who watches the mighty dinosaurs do battle; Flip, the lizard, who loses his tail, but grows a new one; and so on, back through ancestral flesh, fish and worm. Such are the progenitors of Mr. Hamilton Smith, heir of all the ages.

Mr. McKechnie knows his boys and tells their kind of a story. No boy can resist these vivid tales and no boy will fail to understand this panoramic story of the upward climb of the human race. And that includes tomboys.

A. S. B.

GROWING UP, by Karl de Schweinitz, The Macmillan Company, $1.75.

Parents who have wanted a good book for their children on the facts and meaning of sex will find it at last in this most excellent work by de Schweinitz. With its clear simplicity and beautiful pictures, it reads like a child's story book. It is just that to the child, a delightful, new story about himself. The approach is natural and easy, through flowers, fishes and birds to the mammals and ourselves. The entire story is told, the organs and their functions, the sperm and the egg, the meaning of sex love; it is all here, nothing held back, no forbidden or deferred mysteries. The tone, too, is just right,—natural and intimate as a child, without a trace of sentimentality and of moralizing. It will spare parents much embarrassment, for when you stop to think of it, the embarrassment is all theirs, not the child's. The child will be only delighted and probably will come questioning happily to learn more of the thrilling story. This book will start him on the way of clean and frank and healthful thinking.

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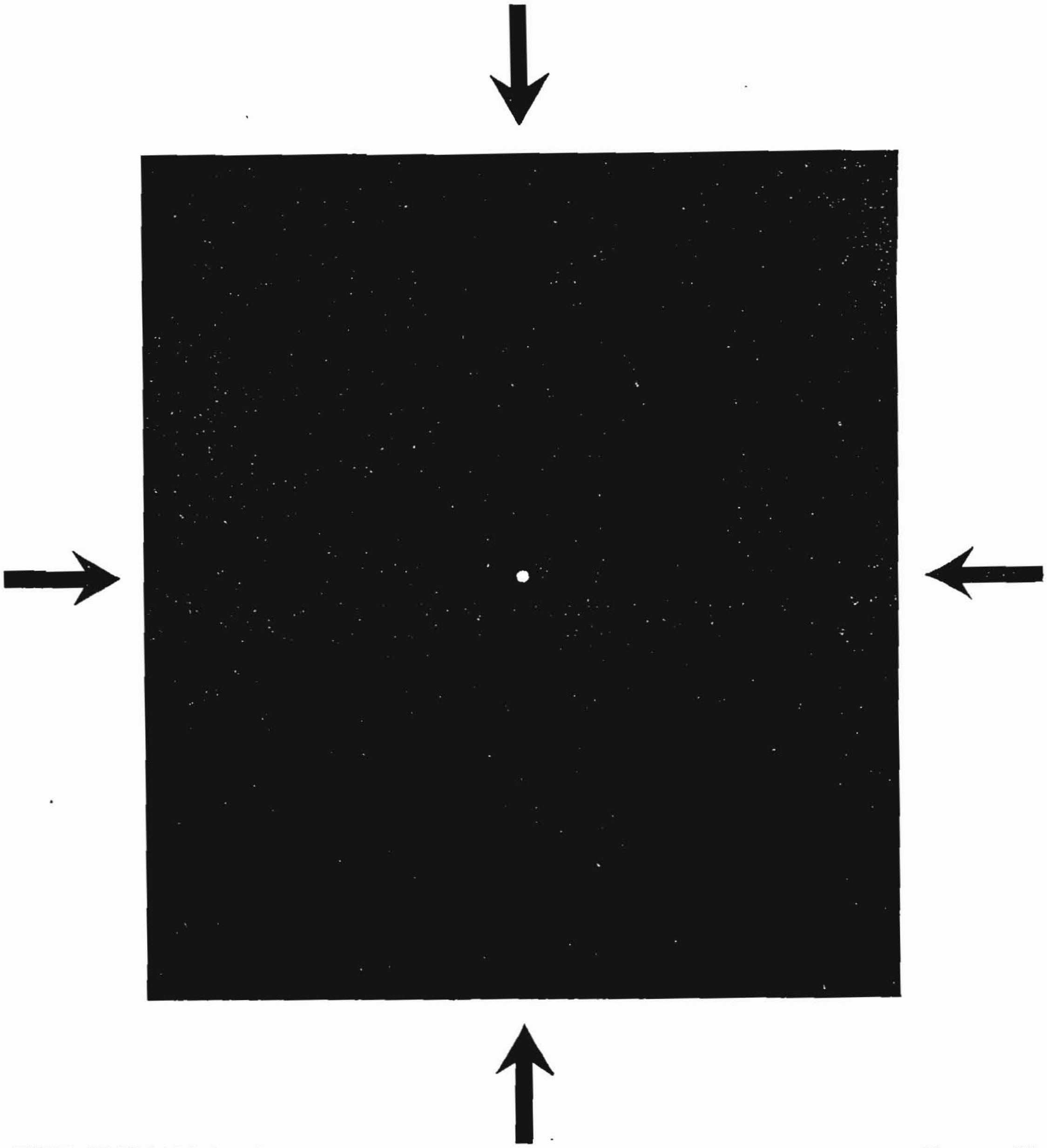


THE HUMAN EGG, magnified ten times.

(See page 14)
Courtesy Macmillan Company

Articles by

Allan Strong Broms, Edward G. Clemmer, Covington Hall, S. J. Holmes, Frederic A. Lucas,
Joseph McCabe, N. K. McKechnie, Hugh F. Munro, Henshaw Ward

The Proofs of Evolution

By HENSHAW WARD

(This is the second of a series of three articles. The first, in September, consisted of two sections, "The Specialists are Unanimous" and "What Breeding Proves.")

III. WHAT THE ROCKS PROVE

THE specialists who study all sorts of life on the earth unanimously believe that the millions of modern varieties have been produced by an evolution from ancient and simpler forms. But they are not unanimous about *how* the evolution worked. For example, some of the men who study life through microscopes feel that Darwin's idea of "natural selection" is not proved. The most famous and outspoken of these was William Bateson. In 1921 he made so strong a speech against Darwin's idea that the newspaper reporters told the world, "Bateson has overthrown Darwinism." To the readers of the papers this meant that Bateson had overthrown evolution.

No wild mistake in the news was ever wider of the mark than this. Bateson was merely discussing, before a convention of specialists, one of the technical details of the theory. The whole burden of his address was that the evolution theory stood unassailed. His closing words were these: "Let us, then, proclaim in precise and unmistakable language that our faith in evolution is unshaken. We have no doubts as to the reality or truth of evolution."

Bateson was much exasperated by finding that ignorant orators against evolution quoted him as an enemy of the theory. So he took pains to make a flat denial of their claims, in these words: "The lines of argument converging to support the theory are so forcible and so many that no alternative can be entertained. The geologic record is conclusive." That is, the story of evolution told in the rocks seemed, even to this skeptical worker with the microscope, an indisputable proof.

It is the most stupendous record that man has ever read. For two centuries the geologists have been at work deciphering it. Every discovery and every guess has been subjected to unsparing criticism. If any investigator won fame by describing a sunken continent or the effect of glaciers or the growth of coral islands, his book was read by a hundred keen skeptics; every one of them would have enjoyed ripping the argument up the back and throwing it on the junk pile. No shred of the story deciphered from the rocks has ever had a chance to survive unless it could stand the wear and tear of the tests put upon it by rival geologists.

No sentence of the vast history is based on imagination. Every paragraph of it is an explanation of facts that we can see with our eyes. The whole mass of proof from the rocks is as matter-of-fact as the three illustrations from everyday life that I give below.

(1) When I look at a field in March and see that a small boulder has been pushed up through its surface, I do not say that some devil has thrust it there to spite me. I ask a man who has had experience with objects that are heaved up in March, and he tells me at once that frost is the cause. He has seen hundreds of rocks and fence-posts lifted in the same way; the explanation always fits; no one has ever found any other explanation—not since fairies went out of fashion. Therefore no sane man disputes the theory that my boulder was pushed up by frost—though no man saw it pushed up.

(2) I see a gully through a ploughed field—the descending steps, the little sand-bars, the assorted pebbles, the scooped-out holes on the sides. I do not argue that an angel has been at work with a diamond trowel. I know from experience—every sane man knows—that rushing water once ran here and wore its bed.

(3) I see a track in a cement sidewalk. I don't say that Jack the Giant-Killer stamped it there after the cement was hard. Nor do I guess that it was made by an ostrich or a seal or a toad. I know that it was made by a dog that stepped on the sidewalk before it hardened.

The history of life on our globe has been pieced together by reasoning that is as plain and solid as the reasoning we all do about tracks and gullies and frost. The history is deciphered from the remains of ancient plants and animals found in rocks, called "fossils." These always occur in a certain order. There is, for example, a series of fossil shells in a cliff in southern France: kind A is near the top, kind B is lower down, kind C is next lower, kind D is lower still. Wherever on the surface of the globe a cliff contains these four kinds of shells, they are always in that same order. If any geologist could find in Utah or Peru or Tibet one single set of rocks in which kind C was above kind B, he would be famous and happy the rest of his life. A young geologist's idea of heaven would be to discover such an error in the history of life. But no geologist ever has detected such an error.

The history written in the rocks declares that there has been an order of development of plants and animals. Not even a Bateson disputes this. He finds the geologic record a conclusive proof of evolution.

IV. WHAT GEOGRAPHY PROVES

In the Pacific Ocean, six hundred miles west of the most westerly point of South America, lie the Galapagos Islands. They are a grim, lonely, and very ancient group of volcanic rocks and small islands that rise abruptly from deep water. On them are found some kinds of birds and shellfish and turtles that are found nowhere else in the world. Where did these come from? Were their ancestors created here, or did they fly and swim from South America?

In the Atlantic Ocean, eight hundred miles from any mainland, the Azores rise abruptly out of water that is two and a half miles deep. They are ancient volcanic islands. On them are some kinds of insects that are found nowhere else in the world. Were the ancestors of these insects created here, or did they migrate from somewhere?

On the other side of the globe, in the South Pacific, are coral islands. They are very young. And there are volcanic islands that are younger still—in fact some of them have been raised out of the ocean within the memory of man. Where do the animals on these islands come from?

The question that I have kept asking about the oldest and the youngest islands is a severe test of the evolution theory. For if evolution is true, the answer must be this: No plant or animal was ever created on an island, but it always descended from some ancestor that migrated to the island. And an evolutionist has to go further. He must say that no new kind of animal could ever be found on a young island. An evolutionist would even have to make this bold statement: The older an island is, the more will some of its animals differ from the original ancestors who swam or flew to it.

The facts bear out that statement. On a brand-new volcanic island not a shred of life is present. The first animals swim or fly to the island. On young islands no peculiar species of plants or animals are ever discovered. But on such ancient islands as the Galapagos some of the species are remarkably altered; they are peculiar to this one place, and are found nowhere else.

None of the sights that Darwin saw in his journey round the world was more astounding and puzzling than this difference between the animals that had not varied on the young islands and the animals that had varied profoundly on the old islands. Darwin was not then an evolutionist. He supposed that animals had been specially created in different parts of the world, and that to talk about their "varying to new species" was quite unscientific. But how could he account for the difference between the animals of the Galapagos and the animals of the young coral islands? It was clear that climate had nothing to do with the difference. The only solution he ever found—the only solution that all the world's naturalists have found since his day—was that when animals migrate to new surrondings their descendants vary to new species in the course of thousands of generations.

Ever since Darwin's day the naturalists have been mapping the geography of plant and animal life—what they call the "distribution" of it. They have gathered an immense body of most complicated facts about everything from moss to grizzly bears. Without evolution their knowledge would be a nightmare of contradictions. When they apply evolution their knowledge can be sorted into an orderly whole. So they consider the geographical facts one of the proofs of evolution.

Mind and Morals

By HUGH F. MUNRO

ALL that we know of human history, so far as it relates to the development of mental or moral characteristics, points to derivation from a lower animal form, believed to be the common ancestor of both ape and man. Tracing history backwards, we find that one after another of those characteristics, upon the possession of which we justly pride ourselves, disappears. Animal instincts and propensities come forward as the motive springs of action until no characteristic is left that can properly be called exclusively human. We have already seen that man carries in his body many vestigial organs, indicating a descent from a pre-human ancestor to whom such organs were useful. In his mental and moral nature he still carries "vestigial" propensities which, normally held in abeyance by his recently acquired intelligence, nevertheless spring up occasionally with the "unreasoning fury of the beast."

The lust, selfishness, greed, etc., which our higher selves find so hard to curb or eradicate, served a useful purpose in the animal economy, and by their nature point to it as their origin.

As dirt is to the chemist only matter in the wrong place, so qualities which were vitally useful to the animal are "evil" when they appear in man.

* * *

There is no doubt in the minds of scientists regarding organic evolution. There is no other hypothesis which can explain all of the facts, and not one fact has ever been brought to light which is incompatible with it.

There is not one of the sciences that have to do with the origin of man but has contributed its quota of evidence, although the data furnished by any one of them would be sufficient. Taken as a whole, their testimony is overwhelming to such a degree that evolution is now the working theory of every competent biologist. The method is still under discussion, but the fact itself has been fully established, never to be overthrown.

The Supreme Law

By COVINGTON HALL

The Soul of Man is builded from a billion years of strife,—
The Iron Law of Struggle is the Supreme Law of Life;
Thru all, o'er all, it follows man wherever he may range,
The urge compelling progress and the power forcing change.

*Time never was when it was not. * * * Where atoms love and hate,*
It sows the seed of destiny, begins the work of fate;
Before the Earth was fashioned, before the Sun began,
Within the warring atom host was born the Soul of Man.

The Universe is subject to its mandate and its will,
Would, but for it, be shrouded in eternal darkness still;
Before the Gods were dreamed of, before the Christs were born,
The armies of the monads were embattled in the morn.

There never was nor will be from the strife of life surcease,
Within the warring Universe no universal peace;
No rest as long as motion lasts, as long as stirs a breath,
For peace is but Nirvana, and Nirvana is but death.

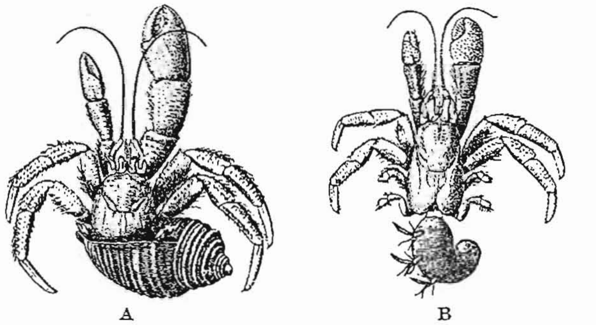
It is the law of being, fixt, immutable and right,
The essence of eternity, infinity and light;
All matter, mind and spirit, all is mothered out of strife,—
The Iron Law of Struggle is the Supreme Law of Life.

A Lesson From Lop-Sided Crabs

By S. J. Holmes

THERE is a very odd family of crabs known in the jargon of the zoologist as the Lithodidae. All the members of this family are more or less asymmetrical, or lop-sided. The philosophical observer is naturally led to ask "How did they get that way? A specialist on crabs can give a very plausible answer.

The species of this family are very diverse in form, size and habits. Large spine forms inhabit the deep waters of the ocean. Small species, usually with rather soft bodies, are found among the rocks near the shore. One of these, Hapalogaster, lives under rocks and has the body very much flattened as if it had been run over by a heavy roller. Another, Cryptolithodes, has the shelly covering of the body drawn out into wing-like expansions that completely cover over the legs. Another is a short, pudgy creature with a form more like that of a typical crab. And there are various others. But amid the great diversity of forms characterizing the members of this group, there are certain well marked resemblances which lead zoologists to class them, without hesitation, in one family. They clearly constitute what is called a natural group.



Hermit crabs. A Pagurus Hirsutiusculus, in a coiled shell. B. Pagurus Samuelis, removed from its shell. Note the egg-bearing appendages on the left side of the abdomen, and the larger right pincer.

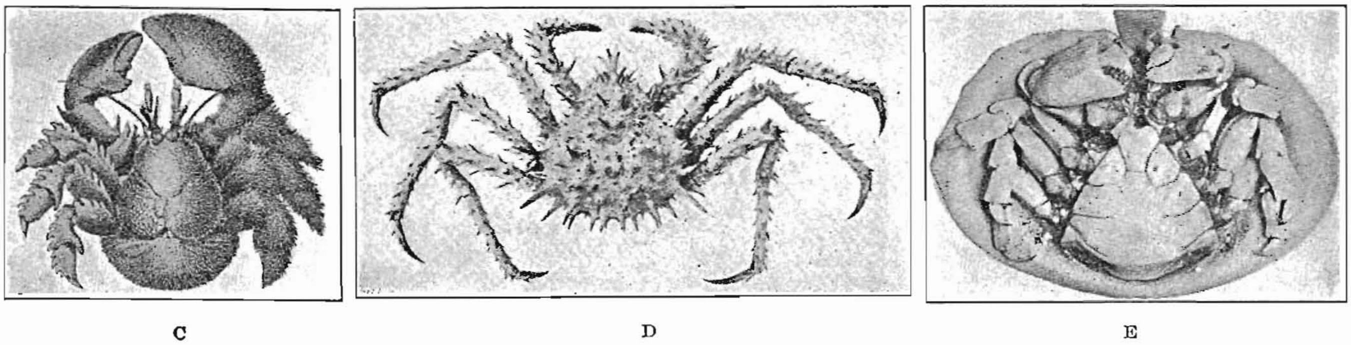
Courtesy University of California

In all the species of the family the right pincer is larger and stronger than the left one. The last pair of legs is small, weak, and imperfectly developed. And, most striking of all, the abdomen is more or less one sided and *has appendages only on the left side.* In ordinary crabs these appendages are symmetrically situated on both sides of the abdomen. They are used for holding the eggs which are carried about by the females until the young are hatched. In the Lithodidae they perform the same function, although the complete absence of appendages on the right side naturally imposes a handicap. It is difficult to imagine any benefit to the species from such a peculiarity. The same condition is found in the large spiny denizens of deep water, the much flattened Hapalogasters, the highly modified, winged Cryptolithodes, and all the other species of this family. Why should all the species have the right pincer larger than the left, while in other asymmetrical crustaceans the larger pincer is found indifferently on either side of the body? The special creationist must assume that God endowed these poor crabs with the same kind of a handicap, quite regardless of their habits and the peculiar features of their environment. The arrangement could hardly be imagined to be of any use to them.

But leaving the creationist to wrestle with the difficulty let us consider what light may be shed by the theory of evolution. According to this theory the resemblances found in the members of a natural group owe their existance to the one cause of likeness among living creatures; descent from a common ancestor. In his endeavor to explain how the Lithodidae gained their peculiar one-sided condition the evolutionist would naturally look to the most closely related group, the hermit crabs. Most species of hermits have the peculiar habit of living in the coiled shell of mollusks into which they insert the abdomen. They present some obvious adaptations to this mode of life. Usually the pincers are unequally developed; the abdomen is soft and more or less twisted to fit the coil of the shell, and in the female is commonly furnished with egg-bearing appendages only on the left side. The posterior walking legs are also small and weak, since they are usually partly enclosed in the shell. They show a marked asymmetrical structure. Individuals frequently leave their shells, especially when they outgrow them, but they usually find a new one to inhabit before leaving their old domicile. The soft abdomen would be likely to fare ill without its customary protection.

The student who attentively compares the Lithodidae with the hermits will be struck with the many close resemblances. He could scarcely fail to come to the conclusion that lop-sidedness of the Lithodidae is a trait inherited from their hermit ancestors which owed it to their habit of living within coiled shells. The Lithodidae are hermit crabs which have left their shells and taken again to a free life. When we consider the close resemblances between these two groups, and the fact that the smaller and more primitive of the Lithodidae resemble the hermits most closely, this is the only rational interpretation that can be made. There are few cases in the organic world where the morphological evidence for descent is so peculiarly cogent.

Only through critically observing and comparing the structural characteristics of related organisms can one gain a really adequate conception of the morphological evidence for descent. Practically all who have qualified themselves to have an opinion by going through this kind of discipline have come to the same conclusion as to the fact of organic evolution.



Various descendants of Hermit crab. Note larger right pincers. C. Hapalogaster cavicauda. Hairs removed from left legs and pincer. Common under rocks at low tide. D. One of larger species of Lithodidae from deep water off California coast. E. Cryptolithodes sitchensis, from below. Male; abdomen therefore shows little twist.

Courtesy University of California

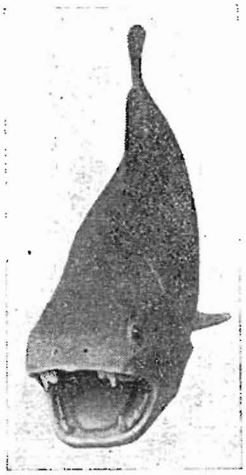
The Earliest Backboned Animals

By FREDERIC A. LUCAS,

Honorary Director, American Museum of Natural History

WE all like to know how things began and it is natural that we should ask, "What is the oldest known backboned animal and what did it look like?" Nature has been questioned in many ways to yield a satisfactory answer, the most direct being to trace back the history of animal life from fossil remains. But this method cannot go beyond a certain point, for the soft bodies of the very earliest animals were not preserved. To help out, the embryologist studies the early stages of developing individual animals, for these throw sidelights on the race history. Finally, invertebrates are studied, the structural parts of some being like those of vertebrates, while others actually are vertebrates in disguise. But these methods, have yielded variant answers, or the replies have been variously interpreted, so that some naturalists consider vertebrates descended from worms, others find their beginnings in crustaceans kindred to the King Crab.

Everyone knows how hard it is to trace a *family* pedigree back a few centuries, how the family name becomes changed and the line of descent obscure and how wide gaps soon appear. It is, of course, much more difficult to trace the pedigree of a *race* that extends, not over a few centuries, but over millions of years. The word "old" as we apply it to fossils has only vague meaning, for we call a family *old* whose pedigree runs back four or five hundred years, when it is actually but an affair of yesterday compared with even recent fossils. We may appreciate this better by recalling that, since the dawn of vertebrate life, enough of the earth's surface has been worn away and washed into the sea to form strata fifteen to twenty miles thick.



Dinichthys, a giant Devonian Fish, as restored by Dr. Hussakof.
Courtesy Am. Mus. Nat. Hist.

At the bottom, then, of twenty miles of rocks the naturalist finds the first scant remains of fish-like prevertebrates, the forerunners of the back-boned animals. The earliest consist of small bony plates, traces of cartilaginous back-bones, and some small conical teeth thought to be those of an animal like the lamprey. A little higher in the rocks, but not in the scale of life, are found a better preserved fish-like creature not over two inches long which is also related (probably) to the lamprey and the hag-fishes. These early vertebrates were so small and soft as to be preserved only when buried in mud immediately after death. Under the later pressure of miles of overlying rocks, their remains are often pressed out thinner than a sheet of paper, so that their shadowy outlines are very hard to trace. With such drawbacks to contend with, it is no wonder that naturalists should differ as to their relationships.

Still higher up we find abundant remains of small fish-like animals, clad in bony armor, indicating that they lived in troublous times when only the well protected could survive. Their plate armor enabled them to defy their enemies or rendered them such poor eating as not to be worth the taking.

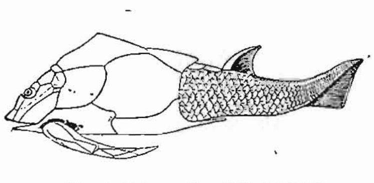
Pterichthys, the wing fish, was another small, quaint, armor clad animal whose remains were once taken for those of a crab. Its buckler, the part usually preserved, with its jointed, bony arms, certainly looks more like a crustacean than a fish. From occasional well preserved specimens we have a very exact idea of its protective cuirass. It had a mouth, of course, but no jaws, for the two do not necessarily go together. Also it had no hard backbone and the hard parts of its fins or arms were not inside but outside, like the legs of a crab.

These fishes and their allies were once the dominant type of life. In favored localities we find great deposits of their protective shields jumbled together. It is thought that portions of the Old Red Sandstone owe their peculiar tenacity to these dead fish. Just as boiling a plaster cast in oil makes it more durable, so the oil from these rotting fish would toughen the surrounding sandstone. Great numbers were probably caught in tidal pools along shallow shores and died when the pools were drained by the tide going out.

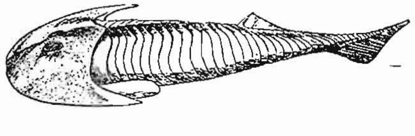
These fishes were little fellows and may be termed orphans of the past as they have no living relatives. Their immediate successors, preserved in the Devonian strata, were the giants of those days, termed, from their size and presumably fierce appearance, Titanichthys and Dinichthys (terrible fish) and are related to the living Ceratodus of Australia. We know almost nothing of their external appearance, however, for though they had powerful jaws and armored heads, they had no bony skeletons, as if they devoted their energies to preying on their neighbors rather than on internal improvement. They attained lengths of ten to eighteen feet; Titanichthys, with a gape of four feet. being able to devour anything known to live then.

Succeeding them, in Carboniferous times, came a host of shark-like fishes, known mainly from their teeth and spines, their skeletons being only cartilage. Almost their only living relative is the little Port Jackson Shark. He also has a spine in front of his back fin and fortunately a mouthful of diversely shaped teeth; fortunately, because through their aid we can form some idea of the arrangements of the teeth found scattered through the rocks. For the teeth were not planted in sockets, as in higher animals, but simply rested on the jaws and were easily detached after death. To complicate matters, the teeth in different parts of the jaws were so unlike that when found separated they would hardly be suspected of belonging together. As the soft parts perished, the teeth and spines were naturally scattered, but from rare specimens that show, not only these hard parts, but the faint imprint of body and fins, we have learned just what teeth and spines go together and often find that one fish has received names enough for an entire school.

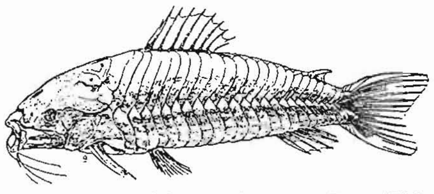
These ancient sharks were not the large and powerful species of today—these came upon the scene later—but were small and fitted (as their spines show) quite as much for defence as offence. But they quickly became the masters of the world, then as quickly declined in numbers, eventually almost to extinction. While sharks again increased, they never reached their former abundance and the species that arose were swift, predatory forms, better fitted to survive in the struggle for existence.



Pterichthys, the Wing Fish.



Cephalaspis, An Ancient Armored Pre-Fish.



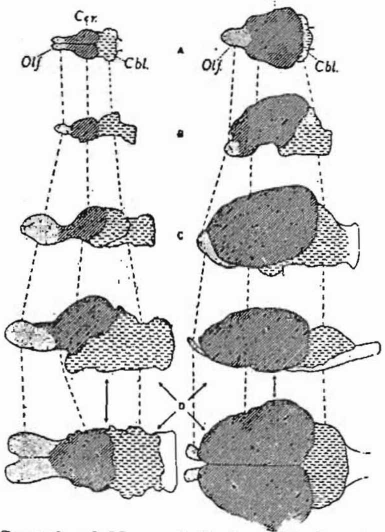
Loricaria, a Modern Armored True Fish

Brains—How Come?

By ALLAN STRONG BROMS

III.

MIND and body are an inseparable pair. Always working together on their one job of living, they just had to grow up together. Certainly we cannot understand the evolution of either without considering the other. In our story of man and his mind, we have already found that it took a partnership between hands and brain to make a man of him and that his wise eyes did their new tricks of seeing and judging only when they got rightly connected in the switchboard of the brain.

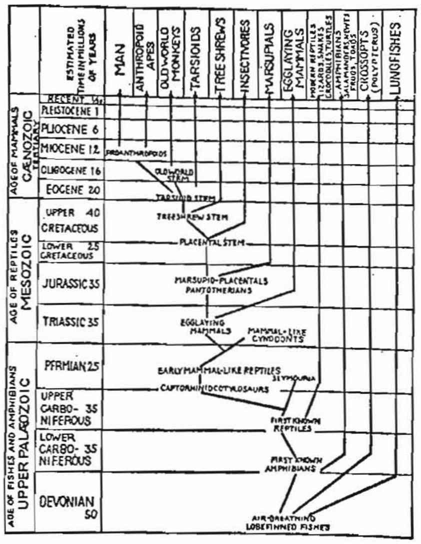


Growth of Mammal Brains. Each pair from ancient and modern animals of similar kind and body bulk.
Arctocyon A Dog
Phenacodus B Pig
Coryphodon C Rhinoceros
Uintatherium D Hippopotamus
Note decrease in olfactory (smell) lobes.

But these are just recent, finishing touches, well within the last ten million years or so, the big start having been made by our remoter ancestors some *hundreds* of millions of years ago. For back of the ape-man and man-ape, back of monkey and tree-shrew, we must look to the primitive mammals, just emerging from the reptile ranks, to find the really big advance from which brains resulted. That big start dates from the acquiring of warm blood.

Our earlier ancestors, the reptiles, amphibia and fishes, were cold-blooded and led but sluggish lives. Some were capable of bursts of speed, but normally they just dozed around. Compare the energetic mammals or birds, both warm-blooded. All animals are engines that burn food-fuels within their bodies to keep themselves going. The cold-blooded tribe are, however, of the low-pressure type, generating only enough energy to get by, while the warm-blooded, high-pressure mammals and birds are a peppy lot, always on the go. The net result for them was bigger and better brains—as we shall see.

What started them off? Bad weather, probably. Perhaps the first of a long string of Ice Ages that repeatedly chilled off much of this world of ours. When the old cold-bloods get caught by freezing weather, all they can do is freeze up, too, and wait for the next thaw to revive them. But when this big freeze came on there was no thaw for thousands of years, and most of the numerous reptile tribe were wiped out.



The Family Tree of the Animals.

According to Wm. K. Gregory

A relative weakling among them, a reptilian-mammal, had acquired the trick of carrying his own warm climate around within himself. This helped him get through the long winter. Evidently the big bullies of his world had kept him chasing around so fast that he developed the hustling disposition, for which good, warm blood was necessary. He raised a whole crop of warm-blooded and active descendants,—predatory carnivores, hoofed herbivores, and some little insectivorous tree-shrews that led on to monkeys and man. His tribe took possession of the world, and blocked any real reptilian come-back.

His blood itself contained more iron—the real bearer of oxygen, — but he also evolved ways and means of making and keeping it warm. He grew himself an overcoat—hair or fur. The birds used down and feathers. He developed mammalian legs, long and strong, to lift his body off the chilling ground. Most of the reptiles just squatted,—and froze. His four-chambered heart stopped the old leaks through which waste-filled blood had mixed with the clean, food-and-air-filled stream. Also his heart was more vigorous in pumping the blood around. Bigger lungs, worked by an active diaphragm, provided the forced draft of fresh air that kept the food-fuels burning intensely. For fresh air plus food-fuels yield living energy. Necessarily he also ate oftener and more heavily.

But there were hot days and hot spots, too, when he had to keep cool or burn out. Of course, he observed the usual hot weather rules, ate little, kept quiet and drank much. Drinking helped a lot, for he had acquired a new trick,—he could sweat. Sweating cooled him, for the moisture, evaporating, absorbed heat, much of it from his body. Also he installed a new thermostat unit in his brain, which automatically controlled all the valves and dampers and what-nots of his system, to keep him cool on the hot days and warm on the cold ones. He was all fitted out to go anywhere and stay through all the seasons. Best of all, he had pep. He could hustle a better living,—those bigger and more frequent dinners he needed to keep up the new pace. For this new pace was faster. The world was soon full of hustlers,—active mammals and birds everywhere, all looking for dinners, each trying to escape becoming someone else's dinner. The struggle for existence became more intense and only the very fittest survived. Natural selection was right there to hunt out improvements and preserve them. Evolution speeded up.

The big improvement was a better brain. Rather it was a new brain area, the neopallium, a clean switchboard not all cluttered up with old, poor connections. It did not happen in a day, of course, but evolved slowly, adding a part here for one job, another there for the next. Some parts gathered sight knowledge, others knowledge from smell or taste or touch or hearing. Certain portions took on the job of keeping the several parts in touch with each other, so they could compare ideas and make well-considered, joint decisions. Out of all this, slowly, came the human brain, so far the last word in its capacity to tackle new problems and adapt action to solve them.

His better brains made the mammal adaptable,—if he was careful about not specializing his body too much. Of course, if he took to the water as a fish-shaped whale, he could not expect to grow hands with which to do clever work and experiments. The birds tried over-specialization for flying purposes and it left them—up in the air. No hands, you see,—beaks being poor substitutes. Man's ancestors somehow stuck to the middle road, kept their adaptable bodies and cultivated the adapting brain. They could meet new conditions by changing their ways, without waiting for evolution slowly to transform their bodies. So they got by more often, raised more youngsters and passed their better brains along.

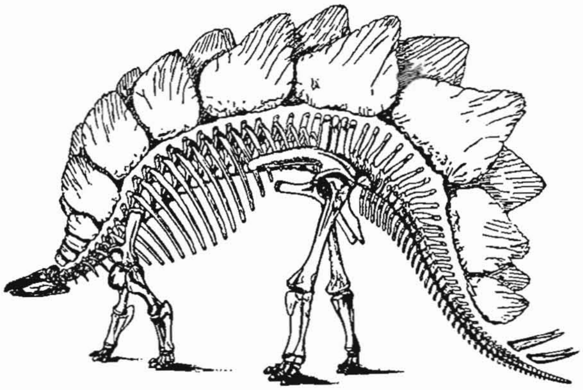
Less hindered by climate, they and saw the world. Always they bumped into all s especially trouble. But more contacts meant more sensation-facts about the world, more things to consider and more actions to decide on. It took brains to develop sensitivity of touch and sight and hearing, brains to boss the lively body, brains to acquire skill in hands and feet and body and eyes. Mammal activity brought lots of troublesome problems and it took brains to work out practical solutions. In this active and aggressive world in which these ancestors of ours lived, better brains counted for more than ever. Natural selection did the rest. Keen competition and climatic severity, those were two big selective factors that forced the growth of the brains that made the man.

The next article will take us back to the fishes, where our hearing and posing and sense of balance began.

The Plated Lizard Stegosaurus

ALL the dinosaurs are extraordinary, but none more extraordinary than Stegosaurus, the plated lizard. He was about as tall as an elephant, but counting his tail, somewhat longer. Unlike some of the dinosaur tribe, he walked on all four feet, but his front legs were relatively small, the tall and massive hind legs being so centered as to carry the burden of his great weight.

Along the back of his body, neck and most of his tail, ran two rows of thin, sharp-edged and alternating plates, like the teeth of great saws. The largest were two feet high and wide and an inch thick, except at the heavier base where it embedded in the beast's tough hide. In life, the plates were probably covered with horn, making them somewhat larger.



Skeleton of Stegosaurus.

Near the tip of the tail, two pairs of large spines took the place of the plates. These spines varied in length with different species, ranging from eight inches to nearly three feet, with the largest base fully six inches in diameter. Like the back plates, the tail spines were increased in outward size by a covering of horn. Swung by the massive tail eight to ten feet long, the tail spines made a most formidable weapon.

But at his other end he was weak, for the head was much too small and the brain inside proportionately even smaller. Intelligence was utterly lacking, the routine functions of life being conducted by the nerve matter of the spinal cord. In fact, a portion of the spinal cord at the base of the tail was enlarged to twenty times the bulk of the brain. When Professor O. C. Marsh made and announced this discovery, the newspapers made the most of it by reporting a creature with two brains and B. L. T. of the Chicago Tribune took the poetic liberty of ascribing doubled intelligence to this most stupid of beasts. His poem makes poor science, but excellent reading.

"Behold the mighty dinosaur,
Famous in prehistoric lore,
Not only for his weight and strength
But for his intellectual length.

"You will observe by these remains
The creature had two sets of brains—
One in his head (the usual place),
The other at his spinal base.

"Thus he could reason a priori
As well as a posteriori.
No problem bothered him a bit;
He made both head and tail of it.

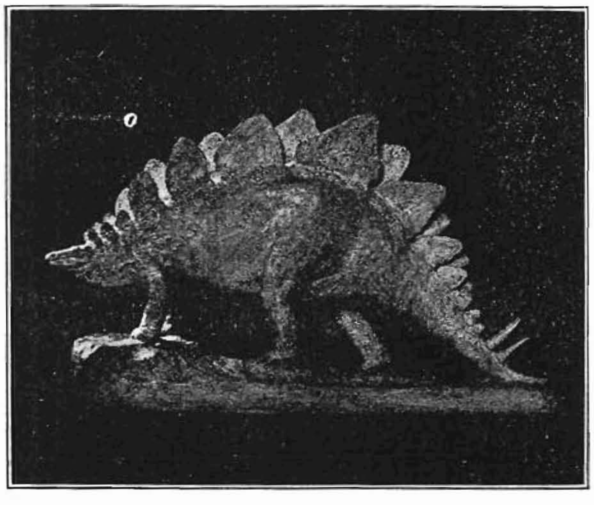
"So wise he was, so wise and solemn,
Each thought filled just a spinal column.
If one brain found the pressure strong
It passed a few ideas along.

"If something slipped his forward mind,
'Twas rescued by the one behind.
And if in error he was caught,
He had a saving afterthought.

"As he thought twice before he spoke,
He had no judgment to revoke;
For he could think, without congestion,
Upon both sides of every question.

"Oh, gaze upon this model beast,
Defunct ten millions years at least."

This "model beast" may be gazed upon at the American Museum of Natural History, New York City, which has a statuette restoration by Charles R. Knight. Yale University has a mounted specimen and the National Museum a life-size reconstruction.



Statuette of Stegosaurus
Courtesy American Museum of Natural History

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ARKANSAS ADOPTS ANTI-EVOLUTION LAW

The fundamentalists have won the first battle in their campaign to take control of the schools of the United States. They have just carried their anti-evolution law in Arkansas by an overwhelming majority. So now it is unlawful, in every tax-supported school of that State, to teach that "man has ascended or descended from any lower order of animals."

This was to be expected. Furthermore, we expect the fundamentalists to secure the adoption of similar anti-evolution laws in every State in which they submit the question to popular referendum vote, as long as the scientific world continues side-stepping this question.

Some wise men in Arkansas actually thought they might defeat the proposed law by keeping mum. Their tactic was based upon the mistaken notion that "the way to defeat the anti-evolution law is to keep the people from finding out what evolution really means." So they did not even try to take advantage of this wonderful opportunity to enlighten the people. Wherever "evolutionists" adopt such an abject attitude the fundamentalists are sure to win.

The opinion of some scientists that it doesn't matter what "the masses" think or believe is also fatal. They must realize that in a republic Mr. and Mrs. Average Man have votes, and their lack of understanding is of serious moment. If Mr. Scientist had to make his home in a swamp he would immediately plan to drain it to make it as healthy as possible for habitation. Yet he lives on serenely in the midst of a swamp of abysmal ignorance far more dangerous to the healthy progress of the race, without any feeling of responsibility toward it. So bigot and demagog take advantage of the situation.

Men of science must become aware of their social responsibility. It is not enough for them to know. They must pass their knowledge along, must try to bring to the mass at least some conception of what The Scientific Method means, at least an inkling of what it means to be scientifically Open Minded instead of dogmatic. They must make popular enlightenment their goal.

The fundamentalists will not stop with Arkansas. That is only their first step. Nineteen other States are open to fundamentalist attack via the Initiative and Referendum route, and they have sworn that in due time they will tackle all of them. And when they have sufficient foundation in these States they intend to put a law through Congress making all books and papers explaining evolution unmailable, besides "forcing the teaching out of every public school on the American continent."

What are YOU going to do about it? Remain discreetly aloof as you did in the case of Arkansas? Wait until the horses are all stolen before you try to shut the barn door? Wait until freedom of teaching is completely abolished before you begin to fight for it?

There is only one road to security of academic freedom. Not the ostrich-like pretense that there is no issue; not the cowardly camouflage that was prevalent in Arkansas; not a resting of the case on quibbles about the "constitutionality" of such ridiculously silly laws, but a NULLIFICATION of those laws through POPULAR ENLIGHTENMENT. Drain the swamps of ignorance through popular education in Natural Science, and the mosquitoes of bigotry that carry the poison of superstition will disappear and the human race will begin to lead a healthy mental life.

This is a tremendous task, but it is a noble task, and EVOLUTION calls on all who will to help. Men of science especially should now come forward as militant champions of the freedom to teach whatever facts are discovered, no matter with what preconceived notions they may conflict. Every opportunity should be utilized to educate the public as to what evolution means. Not only through the class-room, but through the platform, radio, movie, magazines and newspapers, ten thousand spokesmen of science should lift their voices, so that an understanding of the methods of science may replace popular superstition and bigoted belief.

Wherever fundamentalists raise the issue in a State Legislature or by launching a popular referendum the whole weight of every scientific body in the land should encourage the local teachers to make a stand-up fight for academic freedom and support them in it until victory is won.

DANGER IN DEMOCRACY

Those liberals who saw a cure-all for every ill in the Initiative and Referendum are being awakened rather rudely by the use to which this supposed instrument of progress is being put by the fundamentalists. Theres' danger in democracy unless it is based upon popular enlightenment. LET THERE BE LIGHT.

ISN'T THIS AGAINST THE LAW?

Science Service reports that a baby girl born recently in Knoxville, Tennessee, has a tail seven inches long.

RELIGIOUS LIBERTY?

Charles Smith, Atheist, native of Arkansas, went back to his home state to discuss the anti-evolution law.

He found that Arkansas already has a law making it illegal to mention the name of "God, or Jesus, our Savior" except in reverence or worship. So he was put in jail. When he appeared in court he was not permitted to testify because a clause in the Arkansas State Constitution prohibits any atheist from holding public office or testifying as a witness in court.

So in Arkansas our boasted "religious liberty" means only liberty to belong to one or another religious sect. If you don't, you're an outlaw.

TO WHOM IT MAY CONCERN—

Now that Arkansas has adopted its anti-monkey law we'll hear wise-cracks from many smart-aleck editors about the "backwardness of the backwoods", etc.

The fact is that the people of Arkansas stack up fairly well with the average in other States. Religious bigotry is still rampant everywhere. If it came to a popular vote fundamentalism would possibly carry even the States from which our wise editors look down on the rest of the country. Instead of considering the subject taboo as in the past, let them open their columns for some enlightening articles on Man's real place in Nature.

WHY NOT?

Since they have the devil on the run in Arkansas, the fighting fundamentalists should follow up their anti-evolution victory with another referendum to outlaw those twin heresies that the earth is round, and that it revolves around the sun.

* * *

Also, by all means, let's have a referendum to declare gravitation illegal.

* * *

And don't permit any one "in tax supported schools" to teach the circulation of the blood until "the hand that writes the pay-check" has voted on the subject.

* * *

Isn't Genesis a sufficient text-book on physics, chemistry, physiology and geology as well as biology?

"Wise men are instructed by 'Reason'; Men of less understanding by 'Experience'; The most ignorant learn by 'Necessity'." A. Nielen.

"The Vulgar can not remain quiet." Oliver Wendel Holmes.

"Against stupidity the gods themselves fight in vain." Schiller.

"What we have done for ourselves alone dies with us. What we have done for others and the world remains and is immortal." Albert Pike.

Twigs From the Family Tree

By N. K. McKECHNIE

Prologue

At the very summit of a pass in the Andes the traveler crosses a little stream, which if followed in its downward course he will find presently to be divided by a great rock bastion, so that one branch falls away to the eastward and eventually becomes part of a tributary of the Amazon, while the other turns to the west and joins a river that discharges into the Pacific. So a couple of twigs from the same tree thrown into the stream at its fountainhead may end their voyage to salt water with the breadth of a continent between them.

THE STORY

MANY hundreds of thousands of years ago,—so many that the exact number does not matter,—the long earth-wrinkle that now runs across Europe and Asia under the names of the Pyrenees, Alps, Carpathians, Caucasus and Himalaya mountains did not exist, and a semi-tropical forest stretched to the Pole itself.

Within the forest and on the great open spaces it enclosed, lived a multitude of creatures; some suggesting badly-drawn caricatures of animals familiar to us today, others totally unlike anything now living. Of flesh-eaters there were very very few; it was from herbs and trees that the animals obtained their sustenance. But the most striking feature by which the inhabitants of the earth in those days differed from our own was that search the round world over you would find never a man, nor anything so nearly resembling him as even a monkey. The remote ancestor from which the primates were to come was a little squirrel-like creature bursting with life and energy which led an intoxicating existence on the roof of the forest,—an ethereal country suspended between the earth and the sky; a swaying floor of creepers and interwoven foliage, laden with a mold of decayed leaves, moss and rotting wood, watered by thunderstorms, and manured by seed-bearing birds; with grasses growing and great fields of weeds shaded by the tops of the higher trees, perfumed by the great flowers of the parasitical creepers, and steaming with heat.

Here the ancestors of all men now living lived a joyous, carefree life for hundreds of thousands of years.

Then the mountains rose, and, cut off from the warm moist breezes of the southern ocean, the districts to the north changed in character. Gradually, very gradually, the vast luxuriant forests dwindled to scattered wood-lands clinging to moist situations; and from this by regional transitions to the vast prairies of the central European and Asiatic plains or the arid deserts of Tibet.

It was in the first stage of this changing environment that man was born, and the exigencies of our story demand we should view a typical case at close range.

Some millions of years ago on the northern slopes of a mountain range a troop of little animals are scampering across some open ground between two groves of trees. In the lead is the male, the Daddy of the band. He is about the size of an Irish terrier,—for our ancestors have grown considerably since our former glimpse of them—, and runs on all-fours in a clumsy fashion of his own. He doesn't like the solid ground and is much more at home in the trees, but what are you to do when you have exhausted the supplies in one feeding-place? You must naturally move on to the next. And it is well to move quickly because the ground is by no means so safe as in days of yore,—when one did not need to use it.

The flesh-eaters have come!

Not so numerous as they were yet to be, but sufficient to exercise a far-spread influence on their fellow-creatures.

Of these those that shrank from battle adopted various means to escape the Killers. Some took to the water and became seals or whales, some to the air like the bats, some burrowed into the ground like the rabbits and conics, and some like the little ancestors of the horse and deer cultivated the gift of speed.

What will man's ancestors do, bereft as they are of the forests that were their natural refuge from all enemies? Hard times ahead, Daddy! But if it is any consolation to you (and of course it isn't), let us state that not only *to* but *out* of trouble man is born.

Behind the old troop-leader are his harem and a miscellaneous swarm of his descendants,—at least most of them are his descendants. Of these the older of the young males keep a respectful distance from their formidable parent because there has been one of the constantly recurring family flare-ups that always occur when Daddy notices any of his sons taking an undue interest in the females of the band. That is the one thing that the old fellow will *not* tolerate. All dealings with the opposite sex are for him and him alone. And each year sees a certain number of half-grown males driven out from the family fellowship carrying on their persons the marks of their father's teeth. No such heresy as the rights of the younger generation can raise its head in these days!

Daddy reaches the fig-tree that was his objective and in a moment has swung himself upon a branch laden with the luscious fruit. Chattering volubly the band follows him, the tiny babies clinging fast to their mother's fur, and soon all are happy, fingers and jaws fully occupied.

Hunger appeased, their irrepressible spirits as usual find vent in play, and the tree is alive with their little furry forms, scampering along the branches in pursuit one of another, swinging from bough to bough, squealing with delight.

But suddenly there is an angry bark and Daddy comes hurtling through the air towards a young male he has detected in suspicious dallying with a lady. The culprit just saves himself by a lightning spring to another bough. Daddy is hard after him, bent on avenging this renewed outrage to his most sacred feelings. But, alas, advancing years have somewhat diminished his agility, and the active youngster keeps well ahead as they fly from branch to branch and tree to tree. At last the irate parent abandons the chase and returns in a very bad temper to where he has left his flock, pounces unexpectedly on another of his sons who is quite innocently pawing at a comrade swinging from loop of liana, and makes his teeth meet in his shoulder. There is a terrific squeal, repeated again and again as the old boy renews his attack, and this young one is given chase to and driven far away to join his companion in exile.

Then still grumbling, and with the remainder of the males keeping at a wide distance from his vicinity, the ruffled autocrat seeks the soothing society of the gentler sex.

And so it happened that when the next day a forest fire, kindled by a volcanic out-break (of which there were many in those days), came sweeping up the mountain side, the two young males, still separated from the rest of the party, were cut off from following them in their upward flight and barely avoided roasting by the lucky chance of a deep water-course that enabled them to escape with nothing more serious than some singed fur.

The band from which they were thus severed continued its panic-stricken flight before the devouring flames until a spot was reached where rocks and stunted shrubs gave check to their enemy. They entered a wide valley, which though they knew it not was a pass leading to the other side of the range, and here they wandered for two or three years, always moving forward because food was scarce, until at last they came to the southern end of the pass and a billowing sea of foliage lay below them stretching as far as the eye could see,—and thousands of miles further.

They had found the lost Paradise of their remote ancestors!

Let us leave them to the enjoyment of it and return to the two derelicts behind in the burnt-out wilderness.

(Continued in next issue)

Tampering With Tadpoles

By JOSEPH MCCABE

Cases that appear in the press occasionally will have informed you that it is possible to graft flesh on a living body as well as to graft roses on cherry-trees. In the fully formed body there are limits to this power, but with embryos the most amazing results can be obtained. We can take two embryonic frogs, cut them in halves and graft the head half of one on the tail half of the other. This can be done even when they are of different species and different colors, and the frog which they then form is a very curious creature. We can cut out from the embryo of a newt a part of the skin which ought, in ordinary development, to form a nerve, and graft on to the place a group of the cells which form ordinary skin, and the newt will develop no nerve at that spot. We can cut a piece out of the embryo and turn it round, and the newt, when it is fully formed, will have that patch of its anatomy entirely misplaced. Its eyes, for instance, will be on its back, and the back part where the eyes ought to be. We can make the ears grow upside down. We can take the first rudiments of the legs and graft them on the side of the head, and they develop there just as they would in their proper place. I do not say that we can take any organ and make it grow anywhere, but in the case of an embryo in an early stage of development there is a most amazing power of transferring organs in this way. The "vital force" people must imagine that their architect has lost his head under the knife, so to say.

A still more curious series of experiments has been tried. When the embryo of a chick is developing in the egg it is surrounded by a membrane, and someone got the idea of grafting bits of other embryos on this. The budding limbs, for instance, of one chick embryo have been cut off and grafted on the outside of the membrane enclosing another embryo, and they develop there. In short, almost any organ can, in its rudimentary form, be detached from an embryo and made to grow on the outside of another embryo. Eyes, noses, ears, and even internal organs have grown in this totally unnatural medium. When the eyes or limbs or other organs are removed from an embryonic chick, the part of the brain which ought to deal with the working of the missing organ does not develop.

Thus embryologists are now convinced that what we call life is not some mysterious thing that belongs to the body as a whole but that each little group of cells has its own life. Most of us suppose that any part cut away from an organism loses its share of the "life" of the organism or can live no longer. This is found to be quite untrue as far as the embryo body is concerned. We can cut out a bit of the tissue from one of the organs, even the heart or the kidneys, and that group of cells will continue to live and grow; if, of course, it is kept in the proper conditions to feed and maintain it at the hight temperature. In the warm fluid in a little glass tube the heart of the embryo chick, or even a section of the heart, will continue to beat long after it has been cut away from the body. These experiments were started more than ten years ago, and they have already proved a remarkable truth: it is that not only can parts of the body be kept "alive" when detached from it, but they will live a longer time in their isolated condition than they would in the body itself. Sections of the heart of an embryonic chicken have been kept alive in a tube for ten years, which is more than the life of a fowl.

Other series of experiments show the profound influence of environment on the developing body. Concentrated sea-water and other fluids will cause the development of an ovum which has never been fertilized, and some chemicals have curious effects which are quite unintelligible. We take, for instance, the eggs of a certain fish—not any fish—and let them develop in a solution of magnesium chloride instead of sea-water. When the body of the fish is fully developed, it is found to have one eye in the center of its forehead instead of a pair. Tadpole embryos in other chemical solutions have their eyes developed deep under the skin. All kinds of modifications of organs are caused by changing the chemical composition of the fluid in which the embryo is developing.

Some curious experiments in diet throw further light on this influence of the environment. The importance of the thyroid gland is well known, but its effect in the frog world is remarkable. If the extract or secretion of the thyroid gland be fed to tadpoles in an early stage they start at once to develop into frogs. The time these "doctored" tadpoles take to become little frogs is only about one-tenth the usual time. On the other hand, if the thyroid is removed from a tadpole it never becomes a frog.

In short, tens of thousands of experiments have been made on embryos, and the embryologist today finds that he can at will produce the most weird and wonderful forms. He can drug an ovum, and cause it to admit a sperm-cell of an animal of a different species and so make hybrids. He can make half animals or quarter animals or compound animals. He can cut an embryo into pieces and keep the pieces alive in so many glass tubes, the cells feeding, growing and multiplying just as if they were in what we call the living body. I should be inclined to say that he has proved that there is no such thing as a vital force or principle, for, clearly, such a thing could not possibly be divided.

Teacher: "What is the spinal column?"

Little Johnnie in the back seat: "It's a bone what runs up and down your back. Your head sits on one end, and you sit on the other."

JOSEPH McCABE

There may be a few of our readers who do not yet know of Joseph McCabe, who is to lecture under the auspices of EVOLUTION, so here's a little introduction.

Joseph McCabe was born in England in 1867. Trained in various English schools and Louvain University. Was Franciscan Monk, 1883; Priest, 1890; Professor of Philosophy, 1890-1894; Rector Buckingham College, 1895. Left Church, 1896. Ever since then, for over thirty years, he has been writing and lecturing on rationalist, scientific and historical subjects in all the important countries of the world.

Among his writings of over one hundred volumes are: Twelve years in a Monastery, History of the Jesuits, Modern Rationalism, Principles of Evolution, Evolution of The Mind, A. B. C. of Evolution, Story of Evolution, The Ice Ages, and over fifty of the little Blue Books. He is also the author of The Key to Culture, a forty volume series published by Haldeman-Julius, an outline of all human knowledge.

McCabe is known on three continents as "The World's most learned Man", but his constant effort in his writings as well as his lectures has been to make this vast learning available and understandable to the ordinary man.

This year Joseph McCabe is lecturing in Canada, finishing his tour early in January on the Pacific coast. He has kindly consented to fill a limited number of lecture engagements under the auspices of EVOLUTION on his return trip East through the United States. Those that already know him will need no urging to write for a date. Fundamentalists recognize in him their greatest foe, evolutionists their strongest champion. A lecture by McCabe will mean a mental awakening for your entire community.

A CORRECTION

Dr. J. A. Maryson of New York has kindly called attention to an error that crept into last month's article on the "Circulation of the Blood". It spoke of the red corpuscles as "boats of the blood stream carrying food matter and oxygen to the body tissues and carrying away the wastes." The fact is that, though the blood stream does carry food and wastes, the corpuscles carry only oxygen. In condensing this distinction was left out. The red corpuscles contain a substance called haemoglobin which unites loosely with oxygen in the lungs and turns red (being then called oxyhaemoglobin). When the corpuscles get into the body tissues, a difference in condensation causes the release of the oxygen which is then used up in the slow combustion which supplies energy to the living cells. The haemoglobin of the corpuscles then goes back to the lungs for another supply of oxygen.

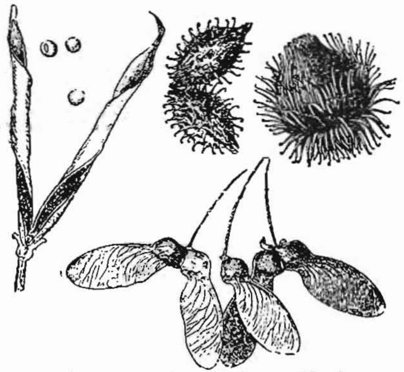
We wish to thank the doctor for his correction. We are trying to keep EVOLUTION free from scientific errors and appreciate the help which our readers may render by calling attention to mistakes.

The Amateur Scientist

A Monthly Feature *conducted by* Allan Strong Broms

HOW SEEDS TRAVEL

A walk through the fields or woods these autumn days gets one all stuck up with seed burrs of spanish needle, beggar ticks, cocklebur or burdock. All have seeds with grapple-hooks to catch the furry coats of wandering mammals and hook free rides to distant spots so the plants may spread widely. Another method, more pleasing to the animals, is employed by the plants that enclose their seeds in tempting, pulpy fruit which ripens in conspicuous and attractive colors so that the seeds may be swallowed and carried away. As the seeds are hard and indigestible, they are presently dropped and thus planted far away from the parent plant.



Bursting pod of wild bean. Hooks on fruits of cocklebur and burdock. Winged seeds of maple.

For a big problem of plant life is to get the young out from under the stifling shadow of the old, a problem serious with us humans, too. Wide dispersal also means larger possible numbers with the consequent greater chances for race survival in the struggle for existence. Every favorable spot can be planted and occupied, so local extinction may not mean race extinction.

In the West, another effective method of seed dispersal is well known in the "tumbleweeds". After growing into large balls of twigs full of seed pods, they break loose and roll off before the wind, shaking out their seeds along the way. Usually they pile up in great heaps against the fences until the wind turns and sends them tumbling over the prairie again. The wind also serves many plants that grow wings on their seeds, the maple, basswood, Bignonia and Ailanthus for instance. Many smaller plants grow plumes and tails and tufts for seed parachutes, such as Clematis, fireweed, bulrush and dandelion.

Water currents of streams or ocean serve to spread many seeds that are buoyant or become so when swelled from soaking. Seeds may be carried over the seas a thousand miles in this manner, if only the ocean currents be right. Seeds buried in mud may stick to the feet of a migrating bird and be carried even farther. That such mud is loaded with seeds was proven by Darwin in one of his patient experiments. From a tea-cup of mud, kept covered for six months, he pulled 537 plants that germinated from the seeds it contained.

Several kinds of plants contrive to throw their seeds for some distance without depending on outside agencies. The fruit of a wild cucumber fills with water until it bursts, squirting a stream and its seeds several feet. The pods of the violet and witch hazel are so constructed that the ripened seeds are pinched and shot out with considerable force. The pods of the wild bean, "touch-me-not" and a domesticated "artillery plant" develop a twisting tension which causes them to throw their seed away violently when they suddenly break. Tropical travellers often hear the detonations of the exploding seed vessels of Hura crepitans, the "monkey dinner bell."

This is the season for wild seed planting. Next spring and summer, when you are down on your knees weeding the garden, you will know how well the job has been done.

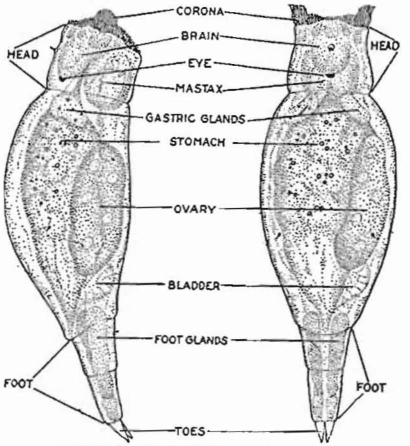
THE WHEELED ANIMALCULE

At the American Museum of Natural History a new group has recently been completed, modeled in glass and wax. magnifying a bit of pond water and its life a million times in volume. The most numerous of the inhabitants shown are the minute animals known as rotifers, whence the name "The Rotifer Group" given to this exhibit. The rotifers are a numerous tribe of many species, seldom longer than one-thirtieth of an inch. They are found almost everywhere in protected waters, either fresh or salt, and are partly responsible for keeping such waters pure and clean by eating the fine decaying particles which would otherwise accumulate and befoul. They are broadly classified into the limnetic or open water group and the littoral group found among the stems of water plants.

Viewed through a low-powered microscope, they are seen to be tube shaped, a tail "foot" at one end and at the other a broad head with what looks like a pair of moving wheels, whence the popular name, the "wheeled animalcule." These wheels are really rows of fine, vibrating hairs or cilia used in feeding and swimming. If the foot remains attached (by means of cement glands), the vibrations of the cilia cause water currents which sweep food particles into the centrally located mouth. When the foot releases, however, the cilia row the animal straight forward quite swiftly. As the body is transparent, the internal organs and processes can be seen. There is a complete digestive system and a simple nervous system with a head ganglion or "brain". It is one of the most simply organized of the multicellular animals and probably not far from the direct line of our primitive ancestors.

Its senses are limited as its possible responses are limited. There may be one, two or more eye-spots and some feelers for touch and perhaps smell. The slightest disturbance, because it means danger, causes the rotifer to retract or swim away. It feeds mostly on smaller unicellular plants and animals, such as bacteria, algae and protozoans. Its simple, yet hardened, "jaws" grind this food before the swallowing. In some species, the mouth parts are modified to pierce plant stems and suck out their contents. In predatory species, the "jaws" are pincers or are otherwise adapted for carnivorous pursuits, even to eating microscopic crustaceans.

The habits vary with the many species. The ordinary rotifers have a protective skin, but a few build hard tubes out of round "bricks" made by the animals themselves out of mucus. Some attach themselves to and are carried around by larger animals. Still others live quietly in colonies. At least one species creeps into the globular body of the protozoan cell colony Volvox, feeding parasitically upon the nourishment of its host.



Anatomy of a typical rotifer (*Pleurotrocha petromyzon*)

Anatomy of typical Rotifer. Side and top views. Corona of vibrating cilia. Mastax or jaws. Foot cement glands for anchoring.

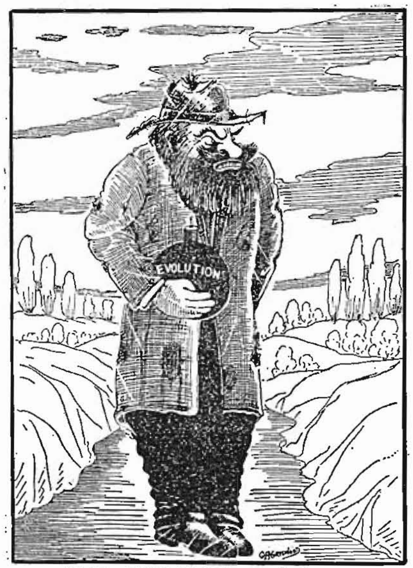
The individuals we usually see are females, the males being smaller, fewer and shorter lived. The female can ordinarily do without the male, for the unfertilized eggs will produce young. But when winter approaches, many small eggs are laid and from them come males in great numbers. The eggs they fertilize are of a tougher breed, able to withstand the winter cold. Should the water dry away, the animal also dries into a speck of dust that the wind can carry off. In this condition, the rotifer (or its eggs) can survive for years. James Murray of the Shackleton Antarctic Expedition sank an eighteen-foot shaft to the bottom of a completely frozen lake, thawed out the mud and got living rotifers, frozen in perhaps centuries before. Because of this tenacity to life, rotifers can be gathered any time, wet, dry or in the egg. and a colony cultivated indoors for winter study.

The American Museum of Natural History, New York City, publishes two booklets, excellently written and illustrated, dealing with the rotifers and the new Rotifer Group. They can be secured from the museum at ten cents each.

Funnymentals

"No person who denies the being of a God shall hold any office in the departments of this State nor be competent to testify as a witness in any court." Sec. 1, Art. 9, Arkansas State Constitution.

"Before deserting their villages citizens of Mascali and Nunziata had taken the statue of St. Leonard within a short distance of the lava stream, hoping the ceremony would halt the flow from the volcano's crater." New York Telegram, Nov 7, 1928.



RED RUSSIAN RAVAGES

It cannot be disputed that there is a world-wide movement to wreck religion, overthrow governments, abolish marriage and usher in a regime with no God and no Bible. The program leaves destruction in its path—political upheavals, crime waves, sex pollution, atheistic campaigns. Russia went down. China is in a death struggle. England and America are threatened. Germany's iron militarism was builded upon the principle of evolution, namely, the idea that MIGHT MAKES RIGHT. We are informed that every prominent military leader in the German army was an evolutionist. The present moral breakdown and general chaotic condition of Russia can be traced directly to the application of animalistic psychology in its national life. Monkey men mean monkey standards of living. The very things that introduced a reign of terror in Russia are being taught through evolution and its by-products, in many institutions of learning. The red fumes of the pit are being wafted around the soul of America at this moment. Unless God speaks; unless America is swept with a Holy Ghost revival; unless the Bible is restored to its proper position; unless the national conscience of America is stirred, our doom is sealed.

—*Defender (fundamentalist) July*, 1928

"Who will dare deny that the ones who sign the pay checks are the ones to say what shall and what shall not be taught to their boys and girls? "Freedom to teach?" Yes, *within the limits I prescribe;* and if he does not like my terms, let him go and seek other employment." George McCready Price, November 1928.

GETTING WORSE AND WORSE

Reverend Leander S. Keyser, D. D., being taken to task in our columns (EVOLUTION, August, p. 12) for saying that ". . . man . . . harks back to the primordial proton or amoeba", hastens to explain (Bible Champion, Nov. 1928, p. 591) that "In a moment of forgetfulness I wrote 'proton' instead of "protozoan', which means first life-form." So the Reverend Doctor now wishes to be understood as affirming that "Evolution now means that man harks back to the primordial protozoan or amoeba and that all forms of present-day life have emerged from . . . a moneron, first life-form, or amoeba."

But since the amoeba is only an evolved moneron, and each is also a protozoon, the last state of the eminent anti-evolutionist's sentence is rather worse than the first! Guess again, Brother.

Edwin Tenney Brewster

WOULD YOU LET A PREACHER CUT OUT YOUR APPENDIX?

By EDWARD GRIEG CLEMMER

The high position of the United States in education is due to the fact that the management has been left to experts. Men and women who have made pedagogy their life work direct our educational institutions. It is to these specially trained people that the public must intrust the working out of curricula, just as we put our confidence in structural engineers to build our bridges, or to bacteriologists to safeguard our health.

The fathers and mothers of law or dental students are never consulted as to what their sons and daughters are to be taught. Nor do the parents interfere, because they know they do not possess the necessary knowledge. They are content to leave the management of law schools to lawyers.

On the same principle, scientists prescribe courses of study for scientific schools.

Now the Fundamentalists want to take this management out of the hands of experts and put it into the hands of people whose job it is to make the wheels of industry go around. They want an automobile man or cigar manufacturer to pass judgment on a line of work that is totally foreign to him.

The average person is not an expert in Paleontology or Anthropology. Then why should he be confronted at the polls with the task of deciding whether Evolution should be taught or not? Let the men whose business is Anthropology decide as to the subjects to be taught in that branch of science. Let the trained biologist, who has spent years of studying, decide, rather than the layman, who usually has not even a smattering of general knowledge, much less a professional education in science.

The Fundamentalist protests that Evolution is a religion, and as the constitution forbids the union of church and state, that Evolution should not be taught in the state-supported schools.

Evolution is no more a religion than relativity is. Evolution is not even taught as a philosophy. It is nothing more than a major tenet of certain sciences, in exactly the same way as the atomic theory or ionization in Chemistry or the law of gravitation in Physics. It is an explanation of many phenomena observed in nature and has been arrived at only through infinite toil.

Are the decisions of experts to be waved aside as "mere guesses" and the great men of science be forced into accepting the dictates of men who are not versed in the subject they wish to outlaw?

The man who is going to the polls to vote on the question of whether or no Evolution should be taught in the public schools should consider if he would want his appendix cut out by a minister.

From Our Readers

"Do you think your argument will gain favor by using the scathing "Funnymentals" column? By such vulgar methods you disgust the better class of educated people. If you have a beautiful, dignified truth to tell why not do it in a beautiful, dignified manner? Why smear it over with slimy mud throwing? I for one am too disgusted with your methods to care for your magazine." Maud Snyder, Nebraska.

"If you were as much interested in where souls spend eternity as you are in Where and How we were created you would be doing some good for humanity. May you get your eyes opened and realize that hundreds of souls are doomed through your theory." Mrs. Warren, California.

"Your good magazine EVOLUTION is a darb! I've spent much profitable time going over past issues, some of the time in deep thought and some of the time in chuckles over the wonderful irrationalism of the 'funnymentalists'." E. L. Van Artsdalen, Illinois.

"Your last number is nearer what your magazine should be. The articles are more readable for the "man on the street". My idea is to avoid writing for evolutionists and to treat your readers as beginners. Herewith check for $30 to be used as you see fit." M. Mark, Indiana.

"It seems to me that you make undue effort to prove something generally accepted by all intellectually developed people. Your opponents are the morons or fanatics, not quite rational human beings. The effort by legal enactment to fetter men's minds and compel the plastic age to accept falsehood and delusion is a return to the dark ages and presents a disquieting and discouraging outlook to thoughtful men." Charles Myers, New York.

"Mr. Bob Lyle of Biloxi sent me a copy. Didn't know there was such a good thing in New York. Enclosed find one dollar for subscription."—Ben Friedman, Tennessee.

"Received two numbers of your journal. It is a great start. I believe this is the only right way to cultivate the great principles of humanity. Let them know themselves. I wish you success. Here's money order for three subscriptions."—M. Haider, New York.

"Unquestionably your rugged and forceful periodical is what has long been needed: a magazine that will not appeal only to the 'high brow,' but as well to the 'man in the street' who has sufficient brains to grasp the simple truths of evolution and to be awakened to the growing menace to popular education in the activities of blatant fundamentalists."—Henry Frank.

To use the human reason
Is "Fundamental" treason;
Just go it blind,
Leave brains behind—
Like tails, they're out of season.
—*Bob Lyle*

FIVE THOUSAND DOLLAR PROMOTION FUND

The time is now ripe for a real promotion campaign to secure the basic circulation of EVOLUTION that is essential to make it a self-sustaining magazine. Judging from results already achieved this can be done with a fund of five thousand dollars. We therefore invite our readers to contribute this amount. For every $10 paid in one share of the preferred stock and with every $50 an extra share of the common, voting stock in Evolution Publishing Corporation will be given. Let us hear from you AT ONCE to help us take advantage of the very favorable situation that has arisen because of the fundamentalist forcing of the anti-evolution law upon the State of Arkansas.

Contributions for this Fund to date are: Michael A. Cohn $20; Martin Dewey $200; M. Mark $30; John A. Bremner $10; Philip E. Adams $10; Wm. M. Wheeler $25; Thomas Barbour $100; H. W. L. Dana $10; Elihu Thomson $200; F. Gosling $30; A. Nielen $100. Total $735.

FOR ARKANSAS EDUCATION

The fact that it is now illegal to teach evolution in the schools in Arkansas will cause many natives that never bothered themselves about such questions before to scratch their heads and wonder what it is all about anyway. This means that they'll be in a receptive mood for EVOLUTION. For every dollar sent in with specification that it be so used we'll send samples to twenty Arkansawyers and give them a chance to subscribe.

Contributions from the following are acknowledged since last report: Barrington Moore, $9; C. A. Johnson $2; Howard Lilienthal $5; Christine Ladd Franklin $10; Margaret Ladd Franklin $1; G. Obergfell $1; L. G. Crandon $4; Mrs. Earl Chichester $.25; F. E. Breithut $10; Harry W. Tyler $4; George H. Parker $4.50.

HONOR ROLL

Many of your friends, who would not take the issue raised by fundamentalism seriously before, will sit up and take notice now that the fundamentalist fanatics have captured their first State by popular referendum. They'll subscribe for EVOLUTION now if you only ask them. Get them for a full year if you can, but, if they will not pay a dollar, collect at least two bits for a trial subscription. Let's enlist you in this Honor Roll.

20 H. Van Voorst
19 Frank Masek
12 Fred Blossom
11 Mae Klavac
11 Geo. H. Parker
8 L. Jaffe
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5 C. D. Foreman
5 H. L. Clark
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4 J. W. Marshall
4 P. B. Cowdery
3 Ben Blanford
3 J. H. Kelly
3 Edith Gwin
3 Aleck Bodnack
3 F. Cassidy

THIS PUZZLING PLANET, by Edwin Tenney Brewster. Bobbs-Merrill Company, $4.00.

Professor Brewster must be criticized for the way he almost apologizes for his literary method,—the method that mixes field-observation, history and biography, as if there were something wrong with that. Why it is this very method that makes his telling so good. I rather suspect he was not apologizing at all.

The book tells the Earth's unfinished story, how men have read it in the past and how the wayfarer may read it today. It is well and amply told, too, even though it is relatively brief and popular. It gives all the leading clues, so that each of us may interpret for himself. As we are all surrounded by "geology" in every rock and hill and sand bank, that gives us unending stories to read—once our eyes have been taught the language. Thereafter there are no tiresome journeys; one need only flatten one's nose against the car window to attain whole days of delight.

This Puzzling Planet is a fit sequel to the author's *Creation; a History of Non-Evolutionary Theories*, that other delightful book which deals largely with the story of biology. There is no fundamentalist comfort in either, for both tell the story of persistent clerical errors, still paraded as final truth by the ultra-orthodox—and laughed at by any one who has studied and knows. Both books are full of ammunition for the militant. Ammunition he certainly needs, for the holy absurdities do not die just because they have been once killed. They still persist, even amongst our enlightened selves, as witness the fact that a full half of our American people still firmly hold to the geology of the Flood of Noah. And of course, no issue of a Fundamentalist journal is quite complete these days without its article upholding this last hope of the theological stand-patters. Brewster devotes a chapter to its history and tribulations that will make the Fundamentalist tear his hair. A. S. B.

LET FREEDOM RING, by Arthur Garfield Hays, Boni & Liveright, $2.50.

The adoption of the anti-evolution law by the State of Arkansas on November 6th emphasizes the timeliness of "Let Freedom Ring" by Arthur Garfield Hays, published recently by Boni and Liveright. It deals at length with the "Scopes Case", that mid-summer farce that had the whole world giggling three years ago. Mr. Hays was one of the dramatis personae and tells the story from behind the scenes, giving many intimate glimpses of the actors.

And he gives a picture of the folk in Tennessee that is an essential part of America, a part seldom seen by visitors to our shores and seldom recognized by our "cultured classes", but which must be taken into consideration in any serious evaluation of the actions of America.

One who has studied science, who has the evolutionary concept, finds it hard to appreciate the viewpoint of those whose lives are ruled completely by dogmatic belief. This study of the Scopes case by Mr. Hays will help to such an understanding. And this is essential to an intelligent handling of the issues raised by militant fundamentalism, encouraged by its victory in Arkansas to try for power.

But to Mr. Hays this suppression of the Freedom of Education is only one manifestation of a quality in American character that also finds expression in other ways. These are indicated by the chapter headings:- 2. Freedom of Speech and Assemblage (Pennsylvania coal mines); 3. Freedom of the Press (American Mercury); 4. Freedom of Residence (Detroit Negro Segregation); 5. Freedom of the Stage (Captive Case); 6. Freedom of Opinion (Sacco-Vanzetti). Each of these cases depicts trials in which Mr. Hayes was a personal participant as one of the Champions of Freedom.

The stories are interestingly told with a wonderful sense of the dramatic. There is no profound analysis of underlying causes, no ultimate solution of problems, but a frank facing of reality which is an essential prerequisite to such analysis and solution. Readers of EVOLUTION will enjoy this book and find it food for thought. L. E. K.

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OUR COVER

Our cover this month shows the human egg magnified ten times. From such a single cell, apparently simple in structure, each of us has grown. By absorbing nourishment from the mother, this cell grows and divides into two, then four, eight, sixteen, and so on until there are millions of them, of all shapes and uses. In this development, the human embryo passes through several ancestral stages of our race evolution, through sponge, worm, fish and tadpole, for example. At one time it has gill slits along its neck and a tail longer than its body.

This cover idea must be credited to the delightful children's book, "Growing Up", by Karl de Schweinitz, which tells them the true story of sex and birth. This is only one of the many clever pictures with which it is so interestingly illustrated.

STATEMENT OF THE OWNERSRIP, Management, Circulation, etc., required by the Act of Congress of August 24, 1912, Of EVOLUTION, published monthly at New York, N. Y., for Oct. 1, 1928.

State of New York,)
County of New York,) ss.:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared L. E. Katterfeld, who, having been duly sworn according to law, deposes and says that he is the Managing Editor of the EVOLUTION and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Evolution Publishing Corporation, 96 Fifth Ave., New York, N. Y.; Editor, none; Managing Editor, L. E. Katterfeld, 96 Fifth Ave., New York, N. Y.; Business Manager, L. E. Katterfeld.

2. That the owner is: Evolution Publishing Corporation, 96 Fifth Ave., New York, N. Y.; L. E. Katterfeld, 96 Fifth Ave., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only a list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails, or otherwise, to paid subscribers during the six months preceding the date shown above, is ——— (This information is required from daily publications only.)

L. E. KATTERFELD.

Sworn to and subscribed before me this 11th day of October, 1928.
(Seal) JOSEPH R. BRODSKY.

Prof. Heber D. Curtis, Director of the Allegheny Observatory, will lecture on "The Unity of the Universe" at the meeting of the Amateur Astronomers Association at the American Museum of Natural History at 8:15 P. M., Wednesday, November 21st.

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By Henry Tracy

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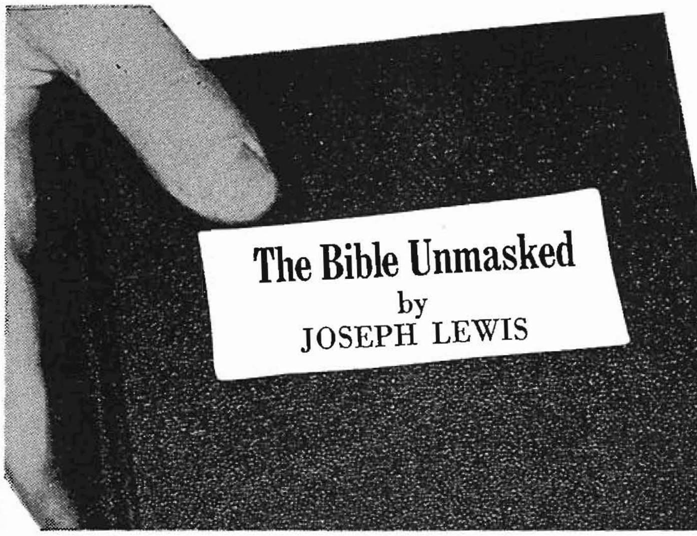

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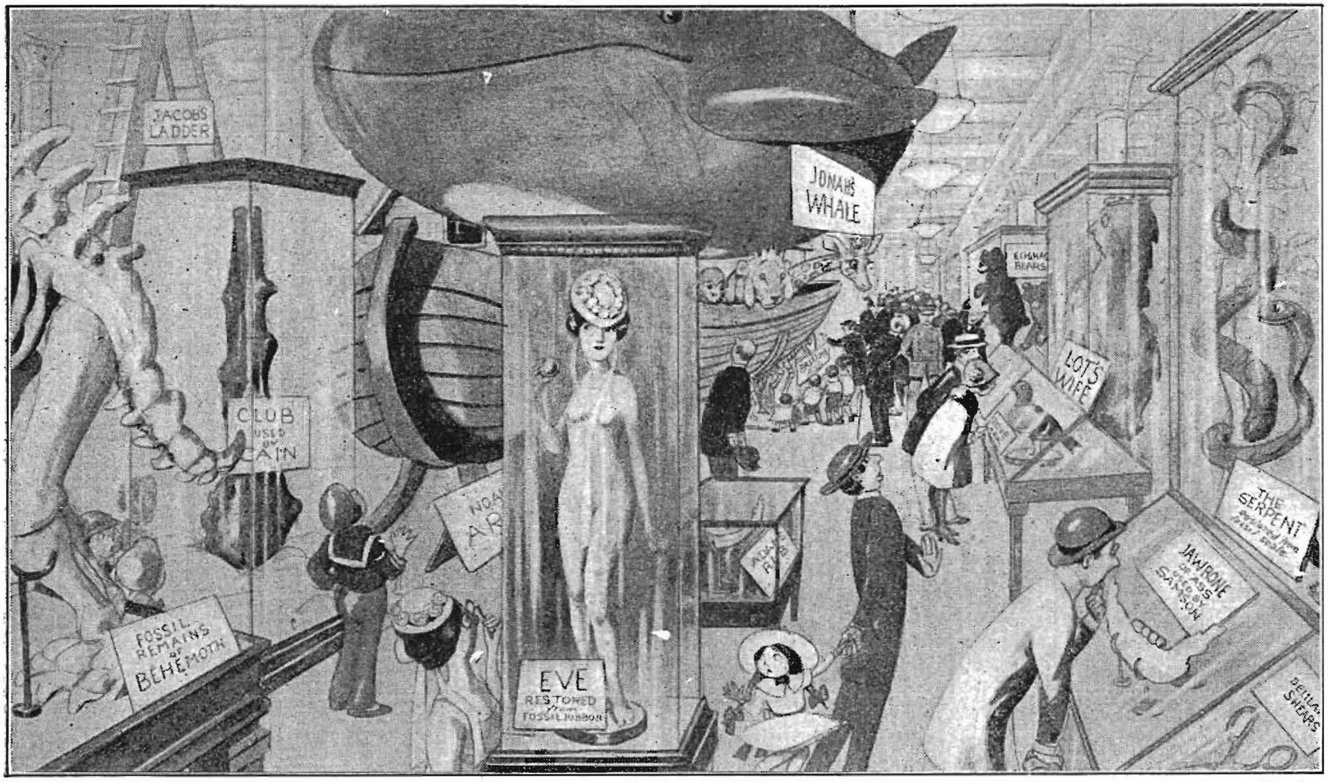

According to Law—In Arkansaw

A "Funnymental" Museum as pictured in "Life" by Oliver Herford. Reprinted with their kind consent. Copyright, 1924, by Life Pub. Co.

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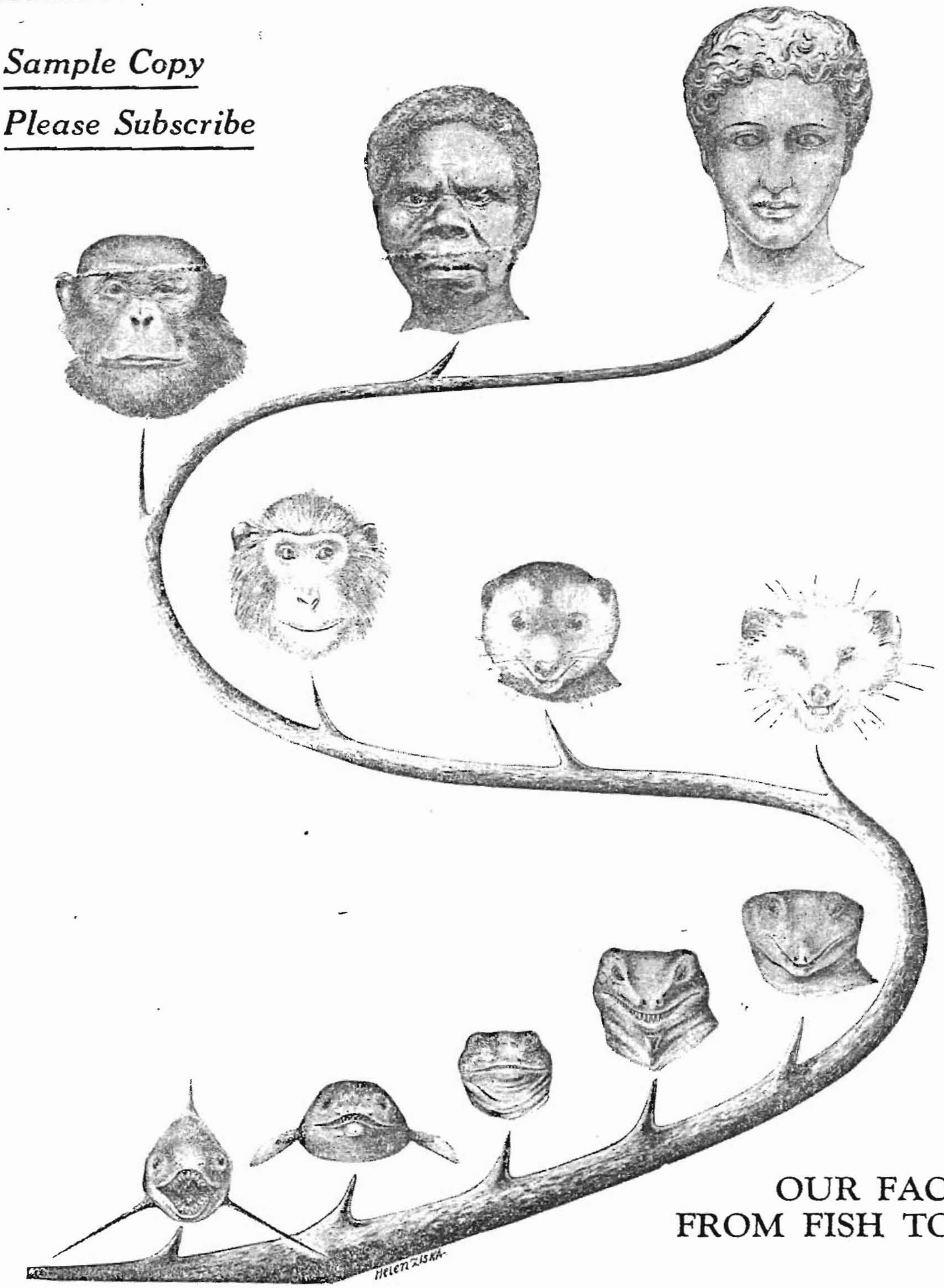


OUR FACE
FROM FISH TO MAN

From "Our Face from Fish to Man" — *By William K. Gregory* *Courtesy of G. P. Putnam's Sons*

Monthly, One dollar per year Entered as second class matter at New York, N. Y. Jan. 7, 1928 Evolution Publ. Corp., 96-5th Ave., N. Y.

New Evidence of Man's Relationship
To The Anthropoid Apes

(*With Kind Permission from a Study in the Journal of Dental Research, April,* 1928)

By J. LEON WILLIAMS

MANY years ago I made a critical study of tooth form in relation to race. The most obvious variations in human teeth occur in the upper central incisors. Examination of over one thousand specimens from all parts of the world showed wide and marked variations *in all races,* with only vague indications of racial peculiarities.

Arranging these teeth according to the most striking peculiarities and resemblances it soon became apparent that there are *three* very distinct forms of human central incisors. Class 1, with sides parallel for more than half their length; Class 2, with sides rapidly converging from the cutting edge toward the root; Class 3, with a double curve on one, and sometimes on both sides. The great majority are various blendings of these typal forms, but in most teeth one or the other is clearly dominant.

An examination of the skulls in the large collection of the Museum of the Royal College of Surgeons of London showed all three of these types of teeth in every racial group. The racial types of teeth which I had expected to find were non-existant. Instead, all races have three types of teeth, with certain minor racial variations. Subsequent study in other large museums and more than fifteen years experience in the examination of teeth in the mouths of living people have established this discovery beyond a doubt.

These same three types of teeth, even more strongly marked in their leading characteristics, are found in the gorilla, the orang-utan and the chimpanzee. As yet these variations have not been found in the teeth of any other animals. These facts have a direct bearing on the controversy now in progress as to the prehuman ancestors of man.

The accompanying photographs illustrate these statements. Figures 1, 2 and 3 are taken from three skulls of Sandwich Islanders. The first exhibits teeth of Class I, having proximal sides that are nearly parallel for more than half their length. The teeth in the second are of the tapering sort, Class II, characterized by sharply converging lines and consequently by wide interdental spaces. The third shows the double curved line on the distal proximal surface, Class III, also with wide interdental spaces.

I have similar sets of photographs of Australian, Ancient Egyptian, Kaffir, Chinese, African, New Hebridean, Hindoo, Spanish, German, Javanese, Fiji Islander, Italian, Tasmanian and others. They all prove conclusively that there is no single form of tooth characteristic of race. For half a century it was taught in college text books that certain forms of teeth are peculiar to certain temperaments. There is not the slightest foundation in fact for this teaching. All peoples, ancient and modern, have three types of teeth.

Furthermore, the previously held views that there is some particular tooth form characteristic of the anthropoid apes, has no foundation whatever in fact. They have the three types of teeth that we find in all human races, with even more strongly marked or bold characteristics. The accompanying illustrations, figures 4, 5 and 6 show all three types of teeth perfectly represented in the orang-utan. Studies of the gorilla and the chimpanzee show the same three tooth types.

How closely they resemble human teeth is shown by figures 7 and 8, showing teeth of Sandwich Islander and Gorilla. The left central incisor of the gorilla was lost. Over the black space in the enlarged print I pasted a photograph of the left central

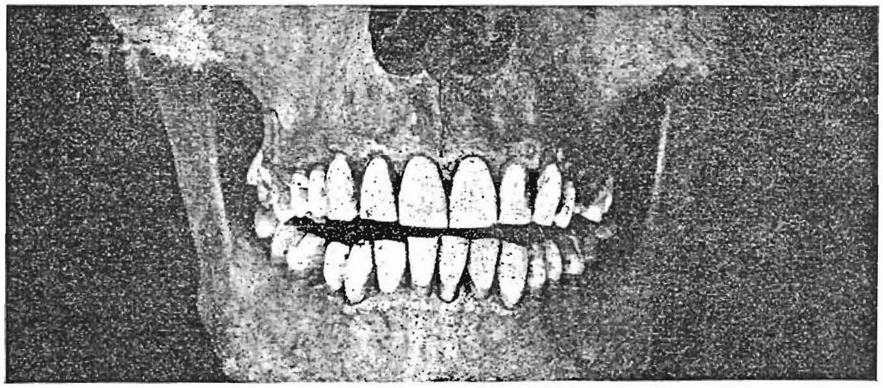


Fig. 1. Sandwich Islander; Class I

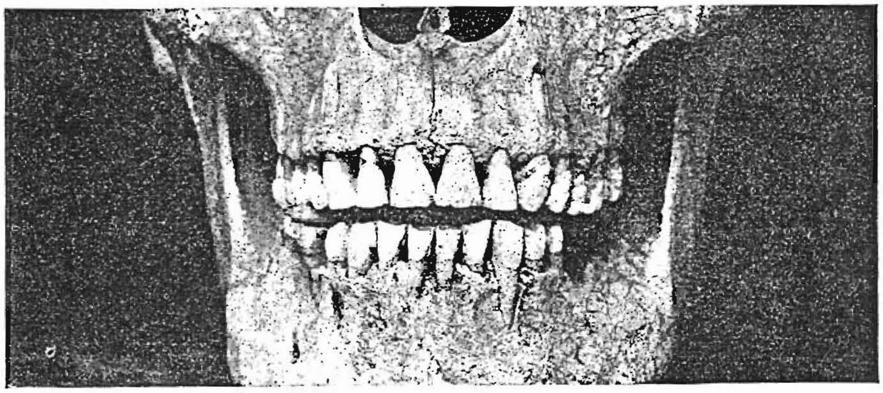


Fig. 2. Sandwich Islander; Class II

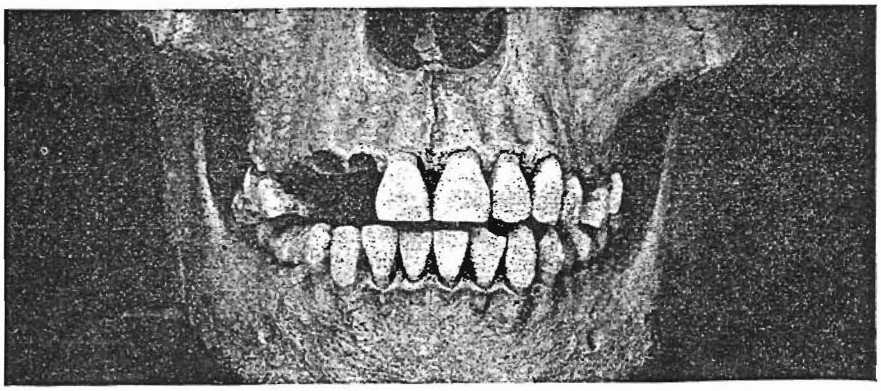


Fig. 3. Sandwich Islander; Class III

incisor of the Sandwich Islander, Both in size and outline the variation is far less than in many human teeth of the same class, and no greater than in the centrals in the illustration beside it from which it was taken.

Most of the other special features which comparative anatomists have pointed out as common to man and the apes, and of such close resemblance as to give strong grounds for belief in a common origin, are so hidden away in the body that only experts in anatomy have first hand knowledge of them.

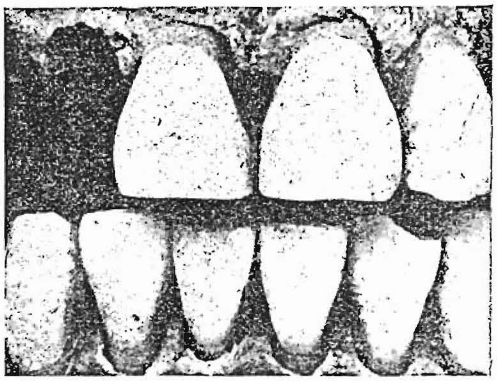


Fig. 7. Sandwich Islander; Class III

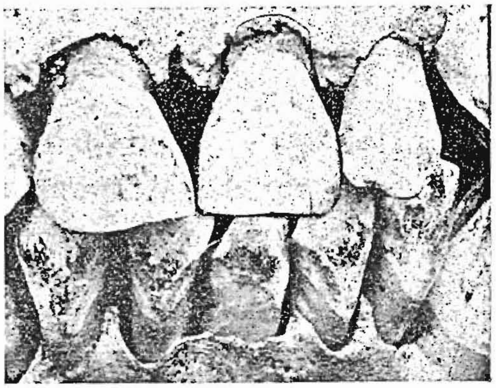


Fig. 8. Gorilla; Class III

Left central incisor of Sandwich Islander substituted for that of Gorilla showing remarkable similarity

But here, in the three types of teeth common to man and apes, we have a feature as open to the perception and understanding of the non-expert as to the trained scientist. The layman will not appreciate the full significance of what he sees, but he will understand enough to give the opponents of evolution an exceedingly difficult task to explain this new evidence away.

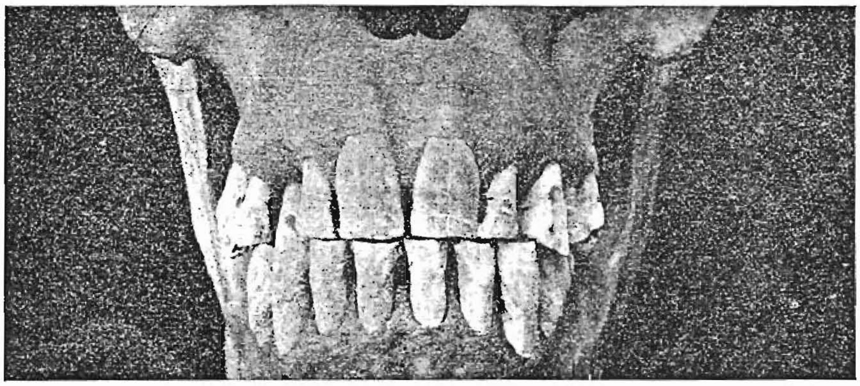


Fig. 4. Orang-utan; Class I

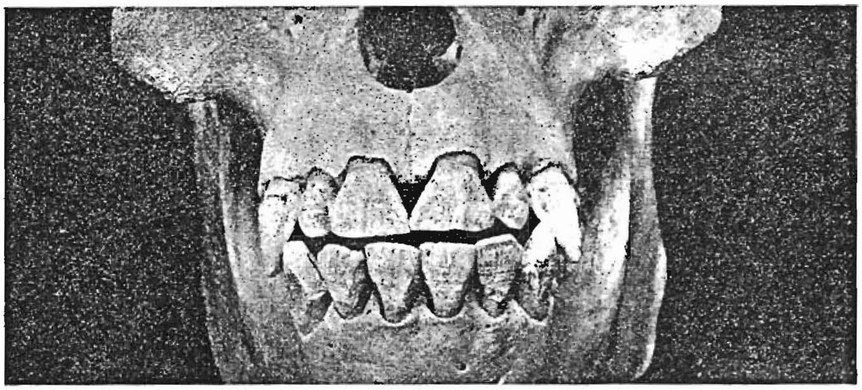


Fig. 5. Orang-utan; Class II

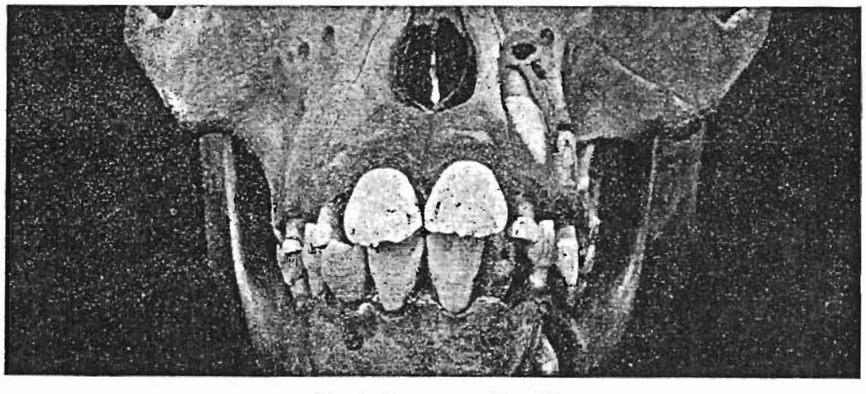


Fig. 6. Orang-utan; Class III

When this photographic evidence was submitted to Professor Ernst Haeckel he expressed himself as follows:

Jena 6, 1, 1913

Dr. Leon Williams,
London.

Dear Sir:—Your observations on the three different types of the upper central incisors are very interesting, and mainly the fact that the same three characteristic types occur also in the orang-utan and in other anthropoid apes. In my opinion this fact is another new and convincing proof for the near relationship between man and the anthropoid apes, and for the phylogenetic theories that both have been derived from one and the same common ancestor. First, the fact that these three types—in physiological relationship of little value—are so distinctly developed in three morphological directions seems to me an important proof that the way of phylogenetic divergence of characters is the same in man and in the anthropoid apes.

Very respectfully yours,
(Signed) ERNST HAECKEL.

With what admirable clearness and conciseness Professor Haeckel has gone straight to the mark in that letter! Three forms or types of teeth have no special physiological significance, as he says. But the morphological meaning conveys the story of man's origin.

In the face of this additional evidence of man's near relationship to the anthropoid apes, what can those say, who hold that "man's ape ancestry is becoming out of date"? I know of no shadow of evidence that man's immediate prehuman ancestors resembled wombats or kangaroos or any other animal known to science, and agree with the paleontologists who hold that the evidence is overwhelming that man's evolutionary ancestors were ape-like animals.

WHAT TO DO—IF YOU GET TWO

Since this issue is mailed to several lists of "prospective subscribers" which it was impossible to check against each other, it is unavoidable that some may receive two, and that some subscribers may get an "extra." In that case please accept it as an invitation to give it to a friend and secure another new subscriber.

Brains—How Come?

By ALLAN STRONG BROMS

IV.

ON the very first page of our family album appears a simple-looking fellow named Amoeba. He is only a speck of living jelly, microscopically small, and formless, without head or tail. He would be a regular lazy-bones if he had bones, for he moves only when hunger or danger prods him. Even then he just pokes around until he accidentally meets a dinner (which he leisurely surrounds) or a danger (which he leisurely avoids). Though nothing to brag of, he surely is of our ancestral stock.

Of course our family has changed a lot from this humble and certainly simpleminded beginning.

The first step in getting ahead was to get a head. As a start, one of the amoebas, the soil dwelling Naegleria gruberi made head and tail of himself. Usually he is just an amoeba, without shape or direction in life, but presently, for a few hours, he turns into a spindle-shaped thing with a head-end crowned by a luxuriant crop of two sensitive swimming-hairs. This end, being a head, travels ahead, bumps into things and needs and develops sensitiveness. This really makes a good beginning and several of the one-celled animals follow suit. Stentor, for instance, anchors by a stalk-end and lifts up its funnel-shaped sensitive head-and-mouth-end for food. When the one-celled evolved into the many-celled, the rule still held. The end that got the contacts, that moved ahead and took the bumps, got the brains.

Already, in the worms the head-end and a very primitive brain are clearly developed. This brain takes the bumps and passes bump messages along its nerves to the body muscles that respond with saving reactions of movement. Often the head-end meets food and sends food messages to the nearby muscles of mouth or tentacles that then respond with feeding reactions. So the head acquired the mouth, a chemical (taste-smell) sense and brain parts to go with them. Then the worm turned—into several sorts of animals, into insects, for example, and more or less directly, into primitive fishes. Just how, we are not sure, but our worm-family resemblance is still there when we are very young and unborn. As part of this development, eye-spots sensitive to light and shadow appeared, quite an achievement, of course, but after all only a sort of touch sensitiveness to finer wave vibrations pounding on the skin. Again the ahead end, where sensitiveness served best, got the receiving set of eyes and some more brain parts—nerves and nerve centers. By this time we were really getting a head.

Head and tail were now distinct. Movement was definitely forward, with occasionally a turning bend to right or left. Body shape and feet or fins were fitted to forward movement. Many of the lower animals moved indifferently in any direction, but now the rule was "head first," for movement was safer and faster that way. Position had become important to effective movement and there developed a group of position senses, among them a sense of balance. Its sense organ is located in the ear and consists of three semi-circular tubes lined with sensitive hairs and filled with a fluid that splashes back and forth when we move or tip, thus disturbing the hairs and our sense of balance or movement. These tubes register movement in three directions, for one is vertical from back to front, telling us when we tip forward or backward, the second vertical again, but set sidewise to catch movements in that direction, while the third is horizontal to tell us when we turn around. This is the one that gives us the dizzy feeling when we have been whirling rapidly around. For the enclosed liquid soon whirls with us and keeps right on when we stop, making us feel that we are still whirling. The business of this three-tube "labyrinth" is to keep track of our movements and balance, aided somewhat by the "feel" of our muscles and bones and by pressures on the soles of our feet.

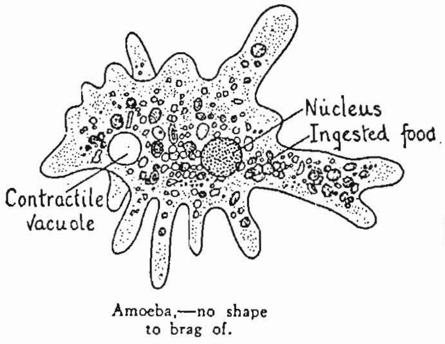
This balancing organ helped the fish keep right side up. Fishes are light-colored below and dark above. Viewed from below, they blend with the sky; viewed from above, they blend with the dark bottom. When they turn over a bit, you catch the white flash at once. The right position therefore helps the fish hide. But it also helps him move fast. Shape and muscle and fin are all fitted to forward movement, with swings to right or left.

But the fish has another position problem, it must head and swim upstream to avoid being swept down and away by the current. The eyes help, for the fish watches the banks and swims to keep abreast of familiar points, but it also has a pair of sense organs to register the water pressure and movement on each side. They are of course up front where the current presses and you and I would call them ears. At this stage, however, they are merely extra sensitive touch spots, somewhat new in structure and the way they work. If the fish turns aside, the water pressure on the upstream side increases and on the the other side decreases. In response, the fish swings up-stream until the pressures balance and he knows he is right with his world. The ears are therefore the upstream compass of the fish.

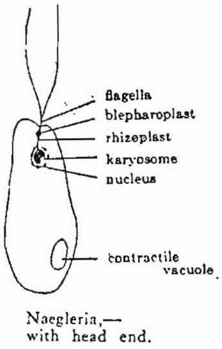
The same organ serves to detect water disturbances that may mean food or danger and therefore need attention. As there is a pair of wave-sensitive organs, the direction of the disturbance can usually be detected, the near spot feeling it more than the other. When later the fishes evolved into amphibians (our frogs being of this tribe) and other land animals, these two ear-spots, sensitive to water-waves, improved enough to detect the more delicate air-waves we call sound. This involved a better mechanism of the inner ear, new nerve connections and brain centers for hearing, and the growing of an outer ear, a sort of ear-trumpet to concentrate more sound waves on the real working ear inside, like your open hand cupped behind your ear to help you hear. Eventually we became acute enough of hearing to distinguish slight differences in sound, an important step towards speech which involves both recognizing and reproducing the sounds we hear. To say a real mouthful, we must first hear a real earful. Of that, more later.

Our organs of hearing and balance are found together because they began together as the position organs of the fish. Thus evolution solves another deep mystery.

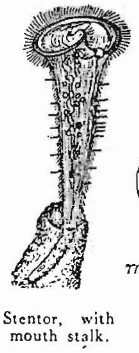
The next number on our program will be "Babies for Better Brains". Oh Baby!



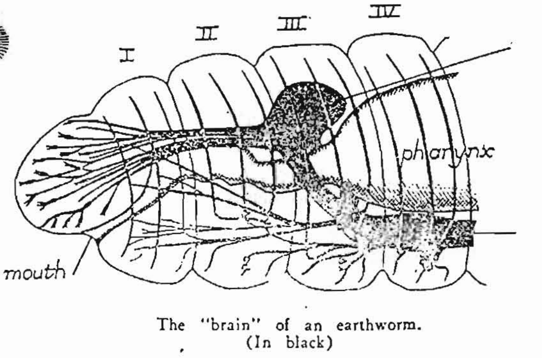
Amoeba,—no shape to brag of.



Naegleria,—with head end.



Stentor, with mouth stalk.



The "brain" of an earthworm. (In black)

Fossil Footprints

By FREDERICK A. LUCAS,

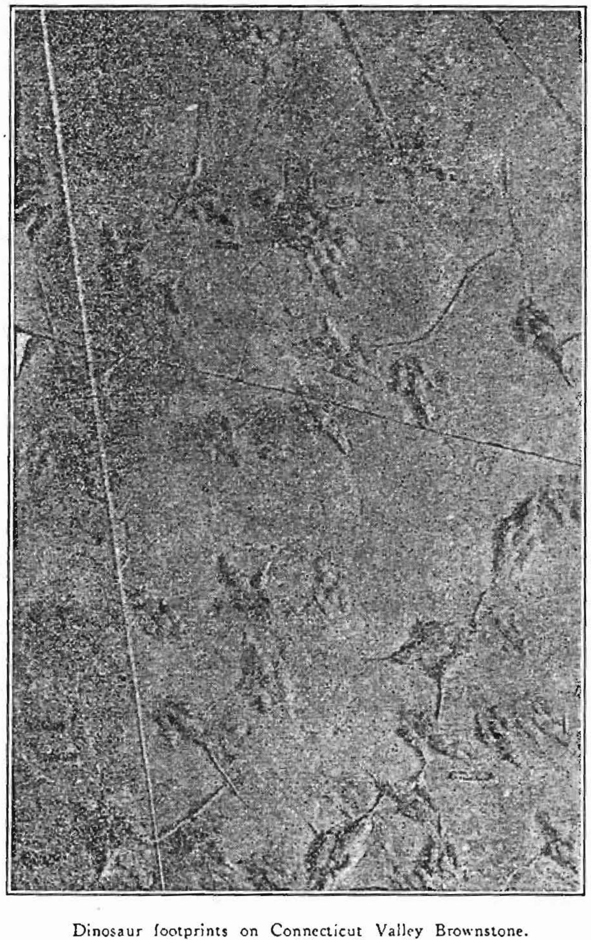
Honorary Director, American Museum of Natural History

EMERSON'S saying that "Everything in Nature is engaged in writing its own history" applies aptly to those animals of yore that left their footprints on the sands of seashore, mud-flats of drying lakes or beds of shrunken water-courses. So too, worms burrowing in the sand, shell-fish trailing over mud at low tide, stranded crabs scuttling off to sea, all left their tell-tale records. Even falling rain and blowing wind disclosed the directions whence they came, or we may read in the record how turbid freshets swept down, perhaps after long drouths, when the sun had baked the drying lake bottoms.

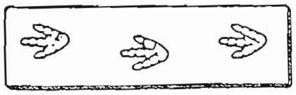
Among the earliest signs of animal life on this globe are some long, dark streaks below the Cambrian in England, thought to be worm burrows filled with fine mud. Above these worm borings, in the middle Cambrian, we find abundant remains of the worms themselves and simple shellfish. From that time on there are tracks aplenty, made whenever conditions favored. We find tracks formed in sands alternately dry and submerged by tide or river, or in soft earth filled with sand or mud.

First came tracks of invertebrates—those worm burrows; curious, complicated trails of the king-crab kindred; broad-ribbed, ribbon like trilobite paths; even faint scratches of insects. Later came footprints of the back-boned tribe; shallow, palmed prints of salamanders; slender lizard sprawls, real footprints, big and little of the Dinosaur horde; and finally, miles above the Cambrian, marks of mammals. Often the footprints are all we have, but in some cases, as with the dinosaur Iguanodon, we also have the fossil foot to fit the print.

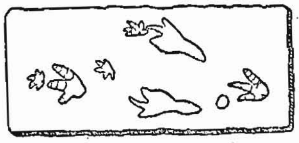
The now famous three-toed dinosaur tracks in the Connecticut valley "brownstone", first seen in 1802, were thought to be bird tracks and popularly called the tracks of Noah's raven. Dr. Deane first guessed the truth that they were due to other animals, partly because some prints showed four and five toes and the texture of the sole of the foot, unlike that of any known bird. Certain long tracks and heart shaped depressions made by hip-bones showed where some dinosaur squatted down to rest.



Dinosaur footprints on Connecticut Valley Brownstone.
Courtesy Am. Mus. Nat. Hist.



Dinosaur tracks



Where a dinosaur sat down.

This part of the Connecticut valley was a river bed or long narrow estuary running southward from Turner's Falls, Massachusetts, where the tracks are most clear and abundant, subject to sudden changes of water level, now left dry to bake in the sun and again covered with water depositing a layer of mud.

The wealth of animal life roaming this estuary may be gathered from the listing of over 150 species. Mere size is however no sure indication of differences in reptiles which grow continuously through their long lives. A single animal may have left his footprints over and over in assorted sizes.

The fine brownstone slab here illustrated measures three by five feet and shows 48 tracks of Protozoum Sillimanium and 6 of a lesser species. Quarried near Middletown in 1778, it did duty as a flagstone for sixty years, fortunately with the face down. When taken up for repairs, the tracks were discovered and it was transferred to Amherst College.

Footprints began to be noticed about 1830 in both England and America, in each case in Triassic rocks. The English tracks were from both dinosaurs and tortoises. Oddly, in both instances the tracks run from west to east, as along a customary migration route, but the animals themselves have not been found. From strata of similar age in the Rhine valley come marks so like a stubby hand that the animal was christened Cheirotherium, "beast with a hand" and taken for gigantic oppossum. But mammals had not yet arisen. The marks were due to giant salamander-like labyrinthodonts, found in the same strata.

Footprints may tell the attitude assumed by extinct animals. Some fine Iguanodon tracks from England and Belgium furnish conclusive proof that many dinosaurs walked erect. Made in soft soil into which the feet sank deeply, the impressions of the toes show very clearly. Had they walked flat footed as we do, long heel marks would have followed the toes. Their absence shows plainly that Iguanodons walked on their toes like birds. Where crocodilians and some short-limbed dinosaurs have crept along we find a continuous furrow between the foot-prints. Since none was found here, we may conclude that these great creatures carried their tails clear of the ground.

According to the papers, some footprints in the prison-yard at Carson City, Nevada, were made by primitive men of giant stature. They were such as *might* have been made by huge moccasined feet, the papers therefore concluding that they *were* so made. Similarly, Mammoth and Mastodon bones have been eagerly accepted as those of giants; a salamander was used as proof of the deluge; and the "petrified man" flourishes perennially. These prints were, however, those of some great ground sloth, a group ranging from Patagonia to Oregon. They looked like tracks of a bi-ped because the hind footprints usually fell upon and obliterated those of the fore-feet. But a few prints of the fore-feet were found, also indications of a struggle between two of the big beasts, for one set of imprints is deeper at the toes, the other at the heels, as if one animal pushed and the other resisted. Some broad depressions with marks of coarse hair show where one sloth sat on its haunches. This prison-yard also contains a great round "spoor" of a mammoth, the hoof prints of a deer and the paw-marks of a wolf(?), indicating that hereabouts was a pool where all these creatures came to drink.

The Proofs of Evolution

By HENSHAW WARD,

(*This is the last of a series of three articles. The proofs described in the previous articles are: I. The specialists are unanimous, II. What breeding proves, III. What the rocks prove, IV. What geography proves.*)

V. WHAT STRUCTURES PROVE

THE breeders have proved that plants and animals can be altered—gradually, through a series of generations—to forms that are very different from the original ancestor. For instance: a small, single daisy growing wild in China has been made to evolve into a double chrysanthemum twenty inches in diameter; heavy draft horses and race horses have been evolved from a common ancestor; the tiny, feeble, hairless dog of Mexico and the fierce, stiff-haired police-dog evolved from a common ancestry. These evolutions are facts in human history, just as the evolution of certain shells is a fact in the rocks. The two lines of proof—from breeders' records and from geology—fit together.

And both these lines of proof agree with a third line—the facts recorded in the skeletons of animals. Suppose that we had before us a set of a hundred photographs of the changes that took place through a hundred generations in the breeding of a small, hairless dog. The first photograph would show a litter of five pups, and an arrow would point to one that was selected because it was slightly smaller and less hairy than the other four. The second photograph would show the son of this pup, slightly different from its father. The third photograph would show slightly more variation in the third generation, and so on to the final product in the hundredth generation. At no point would there be a greater difference between father and son than we are used to seeing in any family of animals, but the difference between the first father and his remote descendant would be amazing.

Now suppose that a second series of photographs showed another line of selection from the original litter, each generation being a trifle bonier and having stiffer hair than the one before it, till in the hundredth generation there was a descendant that resembled a police-dog. Put the two products of evolution side by side, and it seems a miracle that they descended from a common ancestor. Yet any producer of domesticated plants or animals could tell true stories from the history of breeding that are stranger than this imaginary case.

The differences between the feeble pet dog and the fierce police-dog—great as they seem—are all within limits. Each has four legs, two eyes, one nose and one tail. Each has the same number of toes, the same bones in its ears, the same number of sections in its backbone, the same kinds of teeth in its jaws. Therefore a special student of anatomy, if he saw the two skeletons mounted in a museum, would know absolutely that there is a close family resemblance between them. He would know that they are more closely related to each other than they are to a creature with a different sort of spine or a different outfit of teeth.

This one simple case illustrates the way in which anatomists can trace the line of descent in different kinds of animals, by comparing the structures of animals now living and by comparing the fossils of animals. If we see a seal swimming, we may think it is a sort of fish; but in its flippers we find the same five-finger structure that is in all warm-blooded animals and that is not in any fish; we find the same three leg-bones that are in man. We might suppose that a whale is a sort of fish; but it is a warm-blooded animal that suckles its young; its flippers contain the same five fingers and three arm-bones that we have; buried in the flesh of its tail are the remnants of leg-bones and toes. Since its structure is so similar to ours, we know that it is very much more closely related to us than any fish is.

The anatomists have discovered a fossil record of the evolution of the horse; it stretches back millions of years, through forms that get smaller and smaller, through forms that had two toes and four toes, back to an ancestor only a foot high. Almost as complete a series of fossils shows the evolution of the elephant from a snouted creature only three feet high.

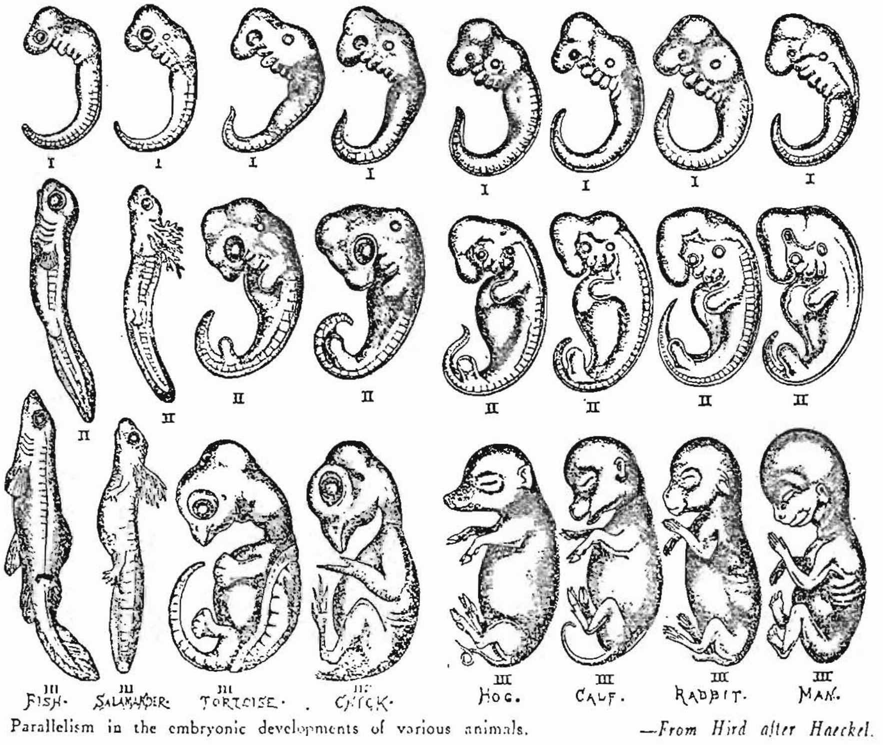
These structures that are found in the rocks, and the structures of the animals that live today, are a record of alterations that have taken place in the course of thousands and millions of years.

VI. WHAT EMBRYOS PROVE

If the proofs in skeletons and islands and fossils all point strongly to the idea that plants and animals have come to their present forms by evolution, their combined evidence is very strong. Their strength is doubled when it is put with the proof that embryos furnish.

Every animal begins its life as a single cell that is too small to be seen with the naked eye. Every mouse and tiger and cow and man begins its career in a sac so small that the most powerful microscope cannot distinguish one kind from the other. This cell divides into two cells, each of these into two others, and so on until millions and billions of them have shaped themselves into an animal that lives inside the mother. This earliest stage of the individual's life is called an embryo. When the embryo of a chick is a few days old in the egg-shell, it does not look like a fowl; it looks like a gill-breathing fish. Also the embryo of a calf or of a rabbit looks like a fish. Also the embryo of a man looks like a fish. The most learned professor in a medical school could not tell, in the earliest stages, whether an embryo is to develop into a rooster or a man.

Every embryo of a warm-blooded animal goes through a development—in its own short career of a few weeks or months



Parallelism in the embryonic developments of various animals. —*From Hird after Haeckel.*

—that is like the evolution of millions of years which is recorded in the rocks. Every man at the beginning of his life had a fish-like structure, and later a reptile-like structure. Much later he was a hairy, ape-like creature. His career of nine months in his mother's womb is like a swift moving-picture of the progress that the fossil record says his ancestors went through in the course of half a billion years.

A careful thinker might be cautious and slow about believing the fossil record in the rocks; for it is not complete and it might be misleading. A careful thinker might hesitate about the record that is reeled off in every embryo—if it was alone in the world and no other evidence told the same story. But what should the most wary thinker decide when he finds that rocks and embryos tell the same history?

Make the case vivid to yourself and get the force of it by supposing that the two lines of proof were revealed to two men on opposite sides of the world. Suppose that a Russian geologist, after ten years of study, had been able to map all the vast pile of knowledge of fossils that it has taken thousands of men two centuries to accumulate. And suppose that an Australian physician could have learned in the same ten years the whole great fund of knowledge of embryos that thousands of physiologists have acquired by a century of toil. Each of these men would marvel and be wary. They would not want to run any risk of being ridiculed by envious rivals for hasty conclusions. But suppose that they happened to meet each other and compared notes. Could they any longer distrust the evidence that came through their two pairs of eyes? The specialists in many departments of the study of life have been comparing notes in that way for the past fifty years. They have unanimously decided that the combination of proofs is absolutely convincing. If they are wrong, the world is a senseless whirligig. If they are right, the world is an orderly and rational place.

VII. WHAT BLOOD PROVES

If a witness tells a falsehood in a courtroom, and if honest witnesses can then be found who will, one after another, tell what facts they know, the falsehood will be disclosed. But if a witness tells the whole truth, no other truthful witness exists under the whole heaven who can contradict any particle of the truth.

If evolution had been false, every recent discovery in geology and medicine would have contradicted evolution. The theory would have died long ago. But the fact is that no recent discovery of science contradicts evolution. The more new knowledge we acquire, the more witnesses we have to the truth of evolution.

The latest and most dramatic proof comes from the blood of animals. It has long been known that blood confirms one of the strangest parts of the evidence from the rocks—that birds are descended from reptiles. The warm-blooded feathered creatures, so unlike reptiles in appearance and temperature, have in their veins the tell-tale evidence of who their ancestors were.

Twenty-five years ago an English chemist learned how to cultivate in a rabbit's blood an anti-toxin that would give an unmistakable reaction when the blood of a horse was mixed with it. Blood from a relative of the horse, such as a mule or zebra, would also give the reaction, but a slighter one. Blood from a more distant relative, such as a cow, gave a much slighter reaction. A long series of most rigorous experiments was made with the blood of many sorts of animals.

Now blood is a more essential part of an animal's make-up than a skeleton is; it reveals family likenesses much more surely. The evidence from blood proves conclusively what man's nearest relative is: it is the chimpanzee. Thus evolution, already proved beyond doubt, has been proved once more.

Scientists at Work—Wm. K. Gregory

By HORACE ELMER WOOD, II

THE man in the street would probably place Professor W. K. Gregory by remembering the newspaper account of a recent controversy in which he stood on the side of Darwin and the ape-man, as opposed to Professor Osborn's advocacy of an as yet undiscovered dawn-man. This controversy, however, is merely the by-product of the most recent of a long series of investigations covering the last quarter of a century.

Dr. Gregory's work is morphological, rather than experimental. It involves the careful comparison of all available relevant specimens and data, noting resemblances and differences. Following this first stage of observation, one or more possible explanations of the facts are developed, what is known as a working hypothesis, or if more than one, multiple hypotheses. (It is the hypothesis which the late William Jennings Bryan stigmatized as "merely a guess"). This hypothesis is then tested out on the data, including, if possible, additional material besides that on which it was founded. If it still stands the test, it may be accepted, tentatively, its degree of probability resting on the amount and kind of evidence. It must still, of course, stand up under the criticism of other scientists, working in the same or adjoining fields, before it can be regarded in any sense, as accepted. That Dr. Gregory's extensive work usually does stand up is the basis of his scientific standing.

The doctor's thesis, in the sciences, usually is a relatively modest piece of research, an article involving a relatively limited problem, undertaken, in most cases, in a painstaking, but often slightly amateurish fashion. It is characteristic of Dr. Gregory that, for his doctor's thesis, he wrote "The Orders of Mammals", covering the structure and interrelationships of all the major groups of mammals. This is still, nearly twenty years later, the standard book on the subject. In such a period, most scientific work is either disproved, relegated to the stacks as unimportant, or completely absorbed in the march of science.

His studies on the comparative anatomy and evolution of the vertebrate skull and limbs represent another high-light. Students are looking forward eagerly to the appearance of his promised book "The Face from Fish to Man", which will summarize the main stages in our evolution. One such summary view appears on the cover of this issue.

There is nothing to thrill the tabloid press in a careful, day in and day out, comparison of the crown pattern of the teeth of one individual or species with another, until each elevation and depression has its own personality, and can be traced through its changes from one geological level to another. Yet it is just these studies which have enabled Dr. Gregory to furnish the final links and corrections in the story of the evolution of the teeth of mammals as a group, and of most lines of mammals, man included. This has led to his work on the general problem of the evolution of man—in which field he is easily the leading American authority.

It is noteworthy that Dr. Gregory is a specialist in several widely separated fields, any one of which would usually furnish a life-time employment for an able man. His linking together of previously unconnected, though logically interrelated fields, has knitted together zoology and paleontology, and emphasized the common heritage of such diverse vertebrates as mud-fish and revivalist.

In addition to the preparation of his large number of valuable publications, Dr. Gregory has time to be Curator of Comparative Anatomy in the American Museum of Natural History. More recently, as Curator of Fishes, in addition, he has been organizing the new "Hall of Fishes". He is also Professor of Vertebrate Paleontology at Columbia University. It is, in the long run, a fair test of a teacher to ask who his students are. A surprising number of leading younger scientists in the fields of zoology and paleontology studied under Dr. Gregory.

Henshaw Ward, in an article in number six of this journal, described an instance (the Hesperopithecus problem) illustrating Dr. Gregory's scientific integrity. To those who know him, it is a question whether this, or his unfailing understanding and kindliness, is the more outstanding feature.

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LET'S CO-OPERATE

"The new attitude toward science on the part of the people as a whole must be met by a corresponding broadening of interests and contacts on the part of research workers. It is only through the window of the press that the people as a whole view science. It is the duty of the scientific workers to assist in helping to make the picture clear and comprehensive," Science, Nov. 30, 1928.

EVOLUTION was established to serve as a useful medium in this effort to "make the picture clear and comprehensive." While it is always strict regarding facts to merit the support of scientists it is also clear and popular in style to be understood by ordinary folk. It is small enough so that none will argue "I haven't time to read it"; cheap enough so none will say "I cannot afford it." Many are taking bundles of it to spread among their neighbors. The rapid growth of circulation during its short existence, in spite of the absence of working capital, already proves that there is a tremendous field in this country right now for just such a journal as EVOLUTION. Every friend of science is invited to co-operate with EVOLUTION, so that it may measure up to the fullest possibilities of usefulness.

OUR POLICY

In view of the fact that this issue of EVOLUTION is going to nearly twenty thousand readers who have never seen it before, we reprint the following editorial statement from our first issue:

"EVOLUTION will be non-political, so that ALL upholders of academic freedom can support and use it no matter how they differ on other issues. It will be non-religious, never making any effort to reconcile science with religion. Nor will it make atheism its mission. It will carry the positive message of facts from every field of natural science and leave it to the reader to make his own mental readjustment."

The favorable reception accorded to this announcement convinces us that this policy will develop a large field of usefulness for EVOLUTION. With full realization of the difficulties involved, EVOLUTION will endeavor to hew to this line.

OUR COVER

The picture on the front cover of this number of EVOLUTION is reproduced in advance of publication by courtesy of G. P. Putnam's Sons from the frontispiece of "Our Face from Fish to Man" by Professor William K. Gregory.

THE GREATEST IN HISTORY

The convention of the American Association for the Advancement of Science and its forty-seven Associated Societies to be held in New York December 27th to January 2nd promises to be the greatest gathering of scientists that the world has ever known.

It has the opportunity to make itself not merely the greatest in numbers, but the greatest in influence and achievement. The old attitude of considering science and learning as something apart from the life of the people is happily passing away. There is a growing sense of social responsibility among men of science. This should not be repressed through considerations of "diplomacy." It should be encouraged to express itself, and grapple with problems regardless of prejudice.

Specifically, the problem confronts this organized gathering of the most prominent men of science what to do about the challenge thrown down by organized religious fundamentalism. The fundamentalist tactic of appealing to popular referendum is stirring the deeps of bigotry, is bringing into action a tremendous reservoir of ignorance that has been latent. Aroused, it may become an overwhelming flood. This problem can not be solved by ignoring it. It must be met. If this convention will frankly face the facts and mobilize its mighty power to meet them, then indeed it will be epoch making and deserving of the title, "The Greatest in History."

PERNICIOUS PRACTICE EXPOSED

On the opposite page we present the first of a series of articles by Barrow Lyons, New York journalist, dealing with the general modification of biology school texts to suit the fancies of fundamentalists. EVOLUTION will expose this pernicious practice of publishers who prostitute themselves for profit.

As an individual the author of scientific texts is helpless before them. But through their organizations scientists might wield a power that would offset the baneful influence of organized fundamentalism and encourage publishers of text books that tell the whole truth.

It is to be hoped that the American Association of University Professors, which has on the agenda of the coming New York convention the subject "Recent Problems of Academic Freedom," will take note of this situation and propose some action.

CONVINCING PROOF

The original study by J. Leon Williams on "New Evidence of Man's Relationship to the Anthropoid Apes" as published in the April number of the Journal of Dental Research, from which our leading article is taken, contains a mass of most convincing detail accompanied by fifty-two illustrations. It took the form of a rather sharp criticism of certain statements made by Henry Fairfield Osborn in his recent book "Man Rises to Parnassus," in which he argues against man's descent from ape-like ancestors. In this Dr. Williams allies himself with Prof. Wm. K. Gregory, Sir Arthur Keith and other prominent men of science, who endorse the theory of man's close relationship to the apes, which is more and more generally accepted by the scientific world.

UNCONSTITUTIONAL?

Somehow we fail to get excited over the question of whether the Arkansas anti-evolution law is constitutional or not. The point should be carried through the courts to be settled once and for all, and we hope of course that this law will be found unconstitutional. It would make it much more difficult for organized bigotry to interfere with freedom of teaching on a state-wide scale.

But we know that even without such a law fundamentalist school board members will not tolerate texts explaining evolution and that they bring up the children in superstitious fear.

To us the great problem is not the constitutionality of the law, but how to educate the people so that they would not vote for such a fool law. This can not be accomplished by a court decision. It is a slow and unheroic task and will not appeal to searchers for the limelight. But it will appeal to every real lover of freedom to teach the truth, it will enlist every earnest fighter against intolerance and superstition.

HOLD FEBRUARY SEVENTH OPEN

A debate is being arranged between Prof. Joseph McCabe and Rev. W. B. Riley on the subject EVOLUTION—FACT OR FAKE? to take place in New York Thursday February 7th. Friends of EVOLUTION, around New York should make no conflicting engagements for this date. Mark it in your calendar and keep it open. Details will appear in next issue of EVOLUTION.

AT LEAST HE'S NO PUSSYFOOTER

Charles Smith, back on his job in New York and looking none the worse for his three weeks starvation on the Arkansas front, reports with a chuckle: "They kept me busy down there painting signs. As fast as I could make 'm they tore 'em up. But every time they tore one up, I made a new one and bigger."

The Great Crime Against Education

An explanation of why the big text book publishers have taken evolution out of biology.

By Barrow Lyons,

If Europe laughed at America when it learned that there were backward sections here where the teaching of evolution was contrary to law, it will howl and guffaw when it learns that the influence of those backward sections has eliminated the mention of organic evolution from most of the biology school books in the United States.

That the fundamentalists have succeeded in aborting virtually all of the biology texts that are placed in the hands of school and highschool children is the testimony of the largest publishers of texts in this country. What is more, the publishers are so afraid of the fundamentalists that they dare not speak out.

The situation is simply this: text book publishing is a business. It is not conducted for uplift, for reform or even for educational purposes. The publishers have all the education they want, but not all the money they want. They run their businesses to make money. When they publish text books that offend any large section of the purchasing public they limit their sales. Limiting sales means increase in production cost. Increasing sales means lower cost and selling price or larger profit.

Text books are sold by price as much as oranges or radiators. School boards prefer to purchase at the lowest prices. The opinions of teachers do not always bear great weight with the purchasers of the books.

The text book publisher who can sell over the widest range of territory has a distinct commercial advantage over the publisher whose field is limited and whose books are slightly higher priced. Thus even the liberal publisher is forced to concede a great deal to the least liberal elements in the community at present.

Notice, we said "at present." If there were an extensive and insistent demand for text books which taught evolution, more of such text books would be published. One of the objects of presenting this situation to the public is to stimulate the demand for books which tell the whole truth.

What Publishers Say

But hear the testimony of the publishers themselves. First, one of the most courageous of large text book publishers.

"Please have it understood at the beginning," this editor commenced, "that the name of our company, or my name, or anything which would tend to identify us is not to be used in your article. It would do the sale of our books no good if the reactionary elements were antagonized. We cannot, as publishers, afford to get mixed up in any controversy."

Staring this man in the face were the bigots of Arkansas, Tennessee, Mississippi, Alabama, Louisiana, Kentucky, Georgia, Texas, Oklahoma, South Carolina, North Carolina, etc.

"Competition makes it imperative that we produce books which can be sold in territory where evolutionary theory is not acceptable to those who control public opinion," he continued. "There are, of course, sections of the country where books which recognize evolution cannot be sold. While I would not say that none of our books have been altered to suit the anti-evolutionists, I can state that this has never been done unless the author was entirely willing.

"We have a text book on biology, which does not contain a chapter on evolution. It has had a great success in the states where evolutionary theory has been under a cloud. In other states it is by no means the preeminent success it has been in the South. In a sincere inquiry as to why this book was not selling better in northern states we consulted our sales force some weeks ago. It was the opinion of some of our salesmen that if the book contained a good, stiff chapter on evolution it would go better in their territory.

How Authors Are Persuaded

"I believe this firm, has shown a great deal more courage in such matters than most firms. The utmost we have done has been to suggest to the author that *mention of evolution was irrelevant to his book and that its omission would increase the book's sale.*"

Needless to say, this publisher chafes under this condition. He sees other large publishers yielding supinely to the influence of benighted crusaders—men whose ill informed minds seethe with superstition and prejudice, and whose influence is poisoning American thought. He sees such publishers gaining the big advantages in trade, increasing their gains at the expense of sound education, doping the minds of American children everywhere.

"You will be doing a great service to publishers who regard their calling as a public trust, who consider themselves a real part of our educational system, if you will call this situation to the attention of the public," this editor declared. "There is too great a tendency to acquiesce entirely to the opinion of Fundamentalists. But let me ask you again, that our company's name be left out entirely. A publisher has virtually nothing to gain by letting it be known that he has endeavored to take a progressive stand, and everything to lose."

If you feel that the stand of this publisher is not entirely fearless, consider the testimony of the next man interviewed. He is editor for a very large house, which publishes text books only. Naturally he obtained immunity against being quoted.

"No one in this company can speak for publication simply because we cannot afford to get into any controversy," he explained. "Our business is to publish books. All of our books, whether on history, religion, economics or science are so written as to give offense to no faction.

"For instance, our history books dealing with labor problems must be particularly careful to make no statements that will offend either capital or labor. The trouble starts, as a rule, when some child goes home and tells his parents what the teacher said or what he read in his text book. When that offends someone the fireworks begin. So we make it a fixed policy with all of our books, either to avoid entirely subjects that offend, or else, in some instances, state what both sides maintain to be the facts, showing no bias either way."

The Truth Suppressed

The thing this publisher is doing seems to me one of the greatest crimes that can be charged against any educational system—the suppression of the truth as seen by the ablest minds who have examined it. We have inherited the accumulated superstitions of the ages. A thousand influences prevent men from thinking fearlessly and straight. It is only as new knowledge is brought forward that the thick mists of ignorance and misunderstanding from which human beings have suffered are gradually swept away. If the facts as they are brought forward and substantiated by science are not presented clearly to young people there is little hope for progress. Yet this great publisher declares:

"We would be foolish to adopt any other policy. One cannot fight prejudice and our sales would immediately drop off if we attempted to. We are one of the largest publishers of text books in the country, but we could not hope to continue to be if we laid ourselves open to the criticism of trying to give people what they don't want. "If any large group of prospective purchasers object to statements in our books, we could hardly expect to sell these books in sections where those statements are not tolerated.

"Virtually all text books on the market have been revised to meet the demands of the Fundamentalists. In some instances, however, practically all of the evolutionary material has been kept in the books, so camouflaged as not to give offense, the word evolution being eliminated."

How one man, who offered his testimony at the famous Scopes trial in support of that teacher, has written such a camouflaged text, will be told in my next article.

I shall also show how important biology texts have been altered to suit the demands of Fundamentalists, so that the majority of school children are being taught biology from books which do not mention, by name at least, one of the most important biological truths that modern science has established.

NEXT ISSUE DATED AHEAD

The next number of EVOLUTION will be out within three weeks, and will be marked Vol. II, No. 1, January 1929. This is to make the volume co-incide with the year and to have the advantage of pre-dating. Of course every yearly subscriber will receive full twelve numbers.

Twigs from the Family Tree

By N. K. McKECHNIE,

Millions of years ago a forest fire drove a family of our tree-dwelling ancestors apart. Most of them escaped over a mountain pass into a warm and hospitable forest land, but two youngsters, who had become separated from the others, were forced by the flames to seek refuge in a deep water-course.

SECOND INSTALLMENT

BITTER indeed was the lot the fire had brought to these, and evil the days that they must endure. Only in the stream-bed that had been their refuge was any vegetation found, and that not of a nature to afford them sufficient sustenance. They eked out its scanty provender with distasteful shell-fish and occasionally a find of turtles' eggs, and wandered on and on until the brook they were following emptied itself into a larger stream, whose farther bank was clothed with trees. Drawn by irresistible desire they essayed to cross by leaping from rock to rock, and here one of the little creatures met his fate. Weakened more than his brother by a month's privation he failed to make good the widest gap and was swept away. But the survivor reached the opposite bank and springing into a walnut tree ate his fill for the first time in many a long day.

For over a year he wandered solitary along the river valley while his little ribs clothed themselves with flesh again and his rough coat once more became sleek and smooth. Food was abundant, and he did not know what else he lacked until one day he encountered some of his own kind, a family group resembling the one to which he had belonged.

With joyful chatter he swung himself through the trees to join them, only to be met by a snarling rush of the old male, whose bristling hair and bared teeth showed plainly the newcomer's presence was far from being desired.

The wanderer checked his advance and hurriedly retired. Although he had now reached his full growth and was quite the equal in size of this surly family head, the habit of subordination to his own father forbade him to dispute a second Daddy's authority. Disconsolate he watched from a distance the gambols of the band and followed them in their rovings day after day, sometimes making timid advances of friendship towards a straggler, that were always cut short by menacing Daddy.

On this being repeated again and again a new emotion began by fits to sway the wanderer's spirit. Sometimes after being chased to a distance by the troop-guardian he would relieve his feelings by futile, unregarded chattering and gnashing of teeth; sometimes while he watched the band at play he would seize the branch on which he stood and shake it until the dead twigs fell in showers; sometimes even his rage would so possess him that he would erect his hair, stiffen his legs till he walked on tip-toe and give a sharp angry bark that infallibly brought the old patriarch upon him, quick to answer the challenge. The wanderer never dared await the onset,—but each time it was more unwillingly that he retreated.

At last came an occasion when he lingered too long and the old male had him driven to the end of a branch from which there was no way of escape. And then suddenly his rage flared up, and he flew open-mouthed at his enemy.

The clash of meeting threw them both off the bough and by sheer luck he was uppermost when they struck the ground, suffered less from the shock than the other, and in a moment was tearing at his opponent's throat. Half-stunned by the shock of his fall the latter made but a feeble resistance and even that faded when a gush of warm blood from a rent jugular welled into the wanderer's mouth. Soon the younger animal felt the body of his adversary grow limp and lifeless beneath him. He worried it a little more, but meeting no response, drew away with a somewhat bewildered air, sniffed inquisitively, looked inquiringly around, became aware of the other members of the band, started towards them, stopped suddenly to look back at his late opponent,—there was no prohibitory sound or movement,—and there and then forgot the past and leapt to meet his new play-fellows.

He was a long way the biggest and oldest male of the troop (owing to the stern disciplinary code of its late leader) and in few weeks' time he was proving himself a worthy successor to the patriarch; —no less than five too-precocious youngsters had been forced into exile!

He thus laid the foundation of a long and safe rule, and begat a numerous progeny. For millions of years his descendants lived and died, becoming numerous when their environment favored them, dying out when it did not, but always leaving survivors adapted to new conditions.

And so in this way the descendants of the Wanderer changed. They became bigger, heavier, less at home in such trees that remained, more inclined to the solid ground. And because they had formed the habit of rising on their hind legs when they reached to a bough above their heads, so they found it often convenient to do so when on the ground, and their feet began to accomodate themselves to the change. And their hand-like front paws came more and more to be used for handling things, and so much the less for bearing the weight of the body while walking. And with the increasing use of the hand came more exercise for the brain, and that again found more work for the hand to do.

Thus it was when, perhaps a million years ago, the first of the ice-ages closed like a hand of death upon their world, they had already become men. The successive glacial-periods were the final testing times by which they were perfected. For times of trouble were always their times of growth,—when they did not die! They sheltered in caves when the first ice-age came, naked hairy long-armed creatures with a stooping shambling gait, whose only tools were clumsy stones held in the hand; they left them at the conclusion of the final one erect, clothed, of a stature and brain equal to our own.

And from that time to ours their history is known. We are their final descendants.

* * *

But of the Wanderer's blood relations who by chance (merely by chance, it would seem) found their way to the lush country on the southern side of the mountain range, a far different story is to be told.

Not for them the stern discipline of an increasingly unfavorable environment with resultant demands upon their latent powers of adaptation. For millions of years no need arose for them to modify the way of living of their fathers. Only their increasing size and weight made them less free of the slenderer-branches of the trees; nearer the ground they must descend, until finally it suited them to come and go entirely upon the forest floor, only ascending the trees to sleep in safety at night. And such was their size and terrible strength when full-grown that even this was unnecessary for the adult male. Secure he slept at the foot of the tree in which his family was established and no night-prowling flesh-eater dare molest him.

But something of the primeval warmth was departing from the earth and as the slow milleniums passed he traveled unconsciously southward through the endless forest to where the sun had fuller power.

It was in the later stages of his long journey that life for him began to be disquieted. Still disregardful of the flesh-eating animals and fearing them not, he was met occasionally now by a strange creature that walked upright as he did and resembled him somewhat, though of much slighter build. True, this newcomer fled hastily at sight of him if the encounter took place in the bush, but sometimes if he had led his band to a feast on the succulent herbs that often grew near the new creatures' dwelling-places, these mysterious beings would appear in great numbers and unprovokedly attack them. And they had the power of stinging unaccountably from distance. So their neighborhood became places to be avoided, which meant a constant shifting of feeding grounds, because the newcomers seemed to be spreading over the whole earth.

Menaced by this invasion that they knew not how to combat, faced indeed now at the end of their time by a test infinitely more stern and swift of action than any that the Wanderer's progeny had had to endure, the forest-folk withdrew deeper and deeper into the as yet uncoveted places of the jungle.

Would you like a glimpse of them at the present day?

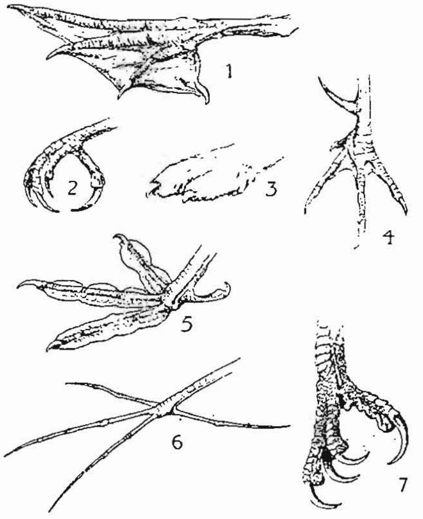
(Concluded in next issue)

THE AMATEUR SCIENTIST

A Monthly Feature *conducted by* Allan Strong Broms

BIRDS' FEET

The delightful thing about science is that it explains plainly the mysterious facts we see about us. It teaches the eye to see facts and read solutions. Take birds' feet, for example. Offhand, the amateur would think of them as more or less all alike, but really look at them once with the eyes of science and you will know them ever after as of distinct types, each telling a story of the life of the bird. For each bird has feet that fit its way of living, and by their feet you shall know them.



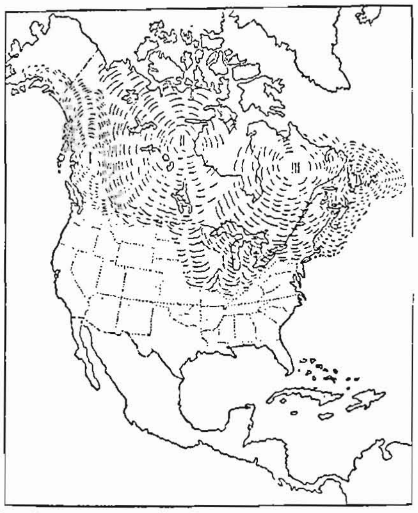
In the picture are seven kinds of feet, each used in a characteristic way. (1) The shag or cormorant has a webbed foot for swimming, as it lives the life of a fisherman. (2) Quite different is the foot of the tree dwelling crow, the toes being long and curved for grasping the branch on which it perches, one of the toes being moved back to encircle the branch from the opposite side. (3) The Ptarmigan lives on the treeless barrens of the arctic regions, and has a foot broad and padded for running and well wrapped in a warm stocking of feathers. (4) The wild jungle fowl needs no stocking to keep warm, but it does walk and stalk about, its flatly spreading toes helping it keep its balance. The fourth toe is lifted a bit and sharpened into a spur, a handy weapon in the jungle battles over some fair hen. With the other toes it scratches a living for the family. (5) The coot or mud-hen just lives in the water, its lobate-webbed feet making good oars for fast swimming and diving. (6) Jacana leads a strange life, walking on floating leaves, its weight well distributed by its long, wide-spreading toes. (7) The strong, curved talons of the sea-eagle tell the whole story of its predacious habits, its swift attack on its fish or other victim, claws striking hard to kill and digging deep to hold and carry off the flesh food it brings home to its family.

Each has its own way of life and its body parts fitted to that life. It has found a place in the affairs of the world and by varying to fit that place it has survived in the struggle for existence. As each found a somewhat different place (environment), there result unlimited varieties, and species and broader groups, each adapted in structure and habits to the conditions into which it grew.

ICE SIGNS

These late fall days of barren hills are good for amateur geologising. The air is bracing, walking is fine and most of you live within the glaciated area shown on the map, within which there is no end of signs of the great, mile-thick ice sheet that covered four million square miles of northern North America within quite recent times. Only one small section in Illinois, Iowa, Minnesota and Wisconsin was not touched by the ice. Europe also had its ice sheet centered in Scandinavia and spreading out over Germany and the British Isles. Perhaps there was but one great ice sheet over the two continents which were then closer together and have since drifted apart. Certainly, however, the ice-cap now covering Greenland is the remnant of the continental ice-sheet that spread from several Canadian centers.

The signs are on the surface and easy to read; clay mixed with boulders and pebbles and sand, heaped into small, rounded hills, just as it was dumped by the melting ice, with little or no water sorting such as we find in water-laid strata; chains of irregular, shallow lakes connected by short streams that wander aimlessly over the topographic maze. Some of the boulders are strangely unlike the rocks native to the neighborhood, and very like other rock beds tens, even hundreds, of miles northward, from which they were quarried and carried by the moving mass. The bed rock itself may be planed, or grooved, or scratched by the heel of the moving ice sheet, a heel full of hob-nail rocks frozen to the sliding glacier bottom.



Ice-sheet centers; I, Cordilleran; II Keewatin; III, Labradorean; IV, Newfoundland.

LOOKING BEFORE AND AFTER

By Joseph McCabe

Someone once defined man as the animal who looks before and after. It is not a bad definition, for all the claims that a bird or wasp, for instance, looks forward, when it builds a nest to its coming progeny, are now disallowed. It requires the higher type of mind which distinguishes man to forecast the future and build up a constructive and entire picture of phases of the earth which have passed away. The chief defect of the definition is that it leaves so few of us really human. Most of us live in the task or the entertainment of the hour.

At the most we know only of the past that our political party won a great victory in the year so-and-so, and of the future only that the football or baseball season opens on such a date. It is a slight improvement on the psychology of the sheep, but it argues some defect in the costly scheme of education which has spent seven or eight laborious years on us.

But if we take the human mind in its higher representatives, the men of science, we seem compelled to say that in the last century or so it has made a prodigious rise in the scale of intelligence. Young men sometimes severely rebuke me after my evolutionary lectures and point out that "there has been no improvement in the human mind for the last twenty thousand years." They picked this up in the works of certain American men of science, not one of whom is an anatomist, and each of whom, has a theological bee in his bonnet. You know what their idea is. Cro-Magnon man, of the late Cave Period, has so large a brain—I won't repeat the dreary catechism. Whatever clues to the texture of the brain—the size alone tells nothing, for only a few ounces of the brain are involved in intellectual operations—an ancient skull may give, it certainly cannot prove the precise power of thinking of the dead man.

The real meaning of this eccentric opinion is "spook-stuff." These professors are not really concerned about the comparison between the brain of Cave Man and ours. They are comparing it with the brain of his predecessor; and they are simply trying, by a desperate twist of the scientific evidence, to prove that the mind made so miraculous an advance in the last phase of the Old Stone Age that evolution cannot explain it, and we must admit the appearance on the scene at last of a real spiritual soul.

Probably the highest achievement of the modern mind in the way of looking before and after is a certain vast mathematical conception of the universe.

I will tell you in my next article why this mathematical estimate of past and future time seems to me so full of important human interest that I would spend months, if necessary, to see that every child was thoroughly and intimately familiar with the outline of it before it left school.

The War Against Evolution

BY MAYNARD SHIPLEY

Now that the smoke is clearing away from the Arkansas battlefield, and we are able to count the dead and wounded of that temporary defeat, it behooves every "soldier in the liberation war of humanity" to look about him and make plans for the coming campaign. For the war will not be over until either the Fundamentalist enemies of science have acknowledged the loss of their bigoted cause, or until all that modern civilization owes to pure and applied science has bowed its head under the heel of fanaticism and ignorance.

The first thing to consider is Arkansas itself. An initiative act cannot be vetoed by the governor; the only way to repeal it, short of another popular vote, which does not promise well, is by three-fourths vote of the legislature. Various agencies are contemplating the bringing of test cases to challenge the constitutionality of the law. In Tennessee the Scopes indictment was so brought that this was impossible; and in Mississippi no test case was ever made. In Arkansas it is possible to work for such a test, which would become a rule for other states also menaced by anti-evolution legislation. Most of the tests considered involve the martyrdom of a teacher. The Science League of America is considering a plan, which would lose no teacher his job, but details cannot be given at this time.

In the meantime, what of the other states? There will be 43 state legislatures in session in 1929, as against nine in 1928. The avowed plan of the Fundamentalists is to bring the usual anti-evolution legislative bill in as many as possible and if the Lower House or the Senate should prove "recalcitrant" and refuse to pass the measure, to have recourse, wherever possible, to direct legislation. Nineteen states besides Arkansas have the initiative and referendum system, and a number of these will hold legislative sessions in 1929. The east and north are by no means being neglected by the Fundamentalist anti-evolutionists. They are, however, most actively at work at present in Oklahoma, Florida, Colorado, and Kansas.

This method of bringing a question of science to the direct vote of the uninstructed lay citizen, tried successfully for the first time in history in Arkansas, holds grave dangers to the cause of scientific freedom. There is small doubt that if a general referendum on the subject of teaching evolution in tax-supported schools were held tomorrow, it would win in many—perhaps most—states. The great mass of the uneducated public is very strongly under the influence of anti-scientific and anti-liberal teaching. And if two thirds of the states should ban the teaching of evolution, a Federal constitutional amendment would become not only possible, but probable.

In this crisis, it is the immediate concern of everyone who values what modern science has achieved, and its right to continue investigation and instruction, to come up and be counted. Magazines like EVOLUTION and organizations like the Science League of America are standing firmly against this invasion of ignorance. But they must have the moral and material support of *all* friends of science and of freedom if they are to be enabled to do the work for which they were started. The situation is no longer a laughing matter; the war has just begun in earnest; and every man and woman who is on the side of the twentieth century in thought and teaching must lend his personal aid lest America be dragged back from the twentieth century to the darkness and ignorance of the tenth.

THREE QUESTIONS

By popular referendum Arkansas has just adopted a law to prohibit the teaching that "man is ascended or descended from a lower order of animals." In view of the avowed purpose of fundamentalists to force anti-evolution laws to popular vote in nineteen other States, EVOLUTION submits the following questions to members of the American Association for the Advancement of Science, under pledge to keep individual ballots confidential:

Yes No

1. Should teaching that "man is ascended or descended from a lower order of animals" be prohibited by law? .... —— ——
2. Should the American Association for the Advancement of Science take a militant attitude against fundamentalist anti-evolution laws?...... —— ——
3. Should the American Association for the Advancement of Science express itself against the elimination of evolution from biology school texts by publishers in fear of fundamentalist influence?........ —— ——

If any reader who is a member of the above organization fails to receive the special questionaire he should write his vote on any sheet of paper and mail it with name and address to EVOLUTION, 96 Fifth Ave., New York before December 20th, so that it can be counted in the compilation. The result will be published in the next issue of EVOLUTION, but individual ballots will of course be kept strictly confidential. Those who wish to write comment for publication should do so on separate sheet of paper, and make it as brief and to the point as possible.

LAST THOUSAND PLEDGED

A friend who has already contributed two hundred dollars during the past year has pledged himself under the name of L. T. B. Light to contribute the last thousand dollars to our five thousand dollar EVOLUTION PROMOTION FUND when the other four thousand dollars has been paid in. Morris Weinberg has promised $200 when the balance of the fund is raised. The amounts paid in to date are:

Reported last issue, $735.00; B. Levett, $30.00; Horace Wood II, $10.00; M. Mark, $50.00; Martin Dewey, $200.00; Wm. K. Gregory, $100.00; J. Leon Williams, $50.00. Total received $1175.00. Pledged $1200.00. Grand total, $2375.00.

This puts us almost to the half way mark. We feel sure that enough of our readers realize the importance of launching an energetic subscription drive RIGHT NOW to make up the balance of the $5,000 fund needed this month.

As stated in our last issue, a share in Evolution Publishing Corporation will be issued for every ten dollars paid in, and an extra share of voting stock with every fifty dollars. Since EVOLUTION has no "angel" we use this method for raising the necessary capital for its promotion. If you would like additional information we shall of course be very glad to furnish it.

HONOR ROLL

This month the list of those who qualified for the Honor Roll by sending three or more subscriptions is short. All the more respect to the good warriors listed here, who were busy on the firing line.

36	A. W. Watwood	5	C. D. Foreman
19	Fr. Masek	5	W. H. Abel
17	Ewald Carlson	4	Alla S. Broms
10	Paul B. Mann	3	Karl Froding
9	F. Cassidy	3	Gustave Weiss

Watch this list grow next time. The battle is developing and a lot of our friends are getting into action. Mobilize yourself and tackle your friends and neighbors. Many of them have now read something in the papers about Arkansas and will be interested to know what the fuss is all about. Others will have heard of the Tennessee baby with a seven inch tail, and will be in the mood to read more. Every subscriber we gain is forever lost to the funnymentalists. Up and at them.

SALUTE FRANK MASEK

One of our readers who never wearies of spreading the light is Frank Masek of Illinois. Seven times in succession he has merited the Honor Roll. His first list of five subscriptions for EVOLUTION was reported in our fourth issue. Since then he has sent seven, five, five, twenty-one, nineteen, and this month again nineteen. And his lists show that these are real subscriptions. He meets them face to face and makes them "sign on the dotted line," which means that they will also read it. A hundred front fighters like Masek will soon make EVOLUTION a power and put the funnymentalists on the run.

THE COMING CONVENTION

From the November 30th issue of Science we glean the following information about the coming convention of the American Association for the Advancement of Science and Associated Societies.

It will be held in New York from December 27th to January 2nd inclusive, and "promises to surpass all earlier meetings in scope, in attendance and in importance to American science." The organization has over 17,000 members and invites not only professional scientists but all who are interested in the advancement of science to join. Entrance fee is $5.00; annual dues, also $5.00, include subscription for Science. This may be paid at the time of registering for the convention. Attendance however is not limited to members; all interested are invited, but every one must first secure a certificate from the registrar. Members pay a registration fee of $1. for the convention, non-members $2. The main registration office is in University Hall, Columbia University. Branches at the American Museum of Natural History, Metropolitan Museum, American Geographical Society Bldg. and the Engineering Building (29 W. 39th), all open from 9 to 6 daily.

The convention is really a large group of conventions held simultaneously, as all forty-seven associated societies will convene during this week. The plan in general is for the subsidiary sections and societies to hold their sessions in the forenoons and afternoons, in various Hotels and Meeting Halls, while each evening there is a General Session and Reception in the large Auditorium of the American Museum of Natural History. Space forbids itemizing the tremendous program arranged for all these meetings but the program for the General Sessions is to be as follows:

Thurs. Dec. 27, Dr. Charles P. Berkey, Columbia University, "Recent Discoveries in the Geology of Mongolia."

Fri. Dec. 28, Arthur H. Compton, University of Chicago, "What Is Light?"

Sat. Dec. 29, Wm. Morton Wheeler, Harvard University, "New Tendencies in Biologic Theory."

Mon. Dec. 31, Arthur A. Noyes, Calif. Inst. of Technology, "The Story of the Elements."

Tues. Jan. 1, Harlow Shapley, Harvard University, "The Gallaxies of Gallaxies—New Developments in the Study of Super-organizations of the Milky Way."

Sunday afternoon, Dec. 30th, there will be a concert by New York Philharmonic Society in Carnegie Hall, and in the evening a reception at the Metropolitan Museum.

Numerous other General Sessions are also being arranged. The full program makes up a book of over 300 pages and will be mailed to non-members for seventy-five cents by the Secretary's office, Smithsonian Institution, Washington, D. C.

A list of the Sections into which the organization is divided, and in which the affiliated societies are grouped, gives a slight idea of the scope of the work: A. Mathematics; B. Physics; C. Chemistry; D. Astronomy; E. Geology and Geography; F. Zoological Sciences; G. Botanical Sciences; H. Anthropology; I. Psychology; K. Social and Economic Sciences; L. Historical and Philological Sciences; M. Engineering; N. Medical Sciences; O. Agriculture; Q. Education; Miscellaneous.

Proposals for the consideration of the convention should be sent to the Secretary's Washington office before Dec. 20th, or handed in personally at the main registration office in University Hall as early in the meeting as possible. They should be "in finished and carefully worded form," and are then first referred to the Executive Committee, which meets in the Lincoln Hotel each morning at ten o'clock. The Council of the Association holds its first session in the Library of the Lincoln Hotel Thursday Dec. 27 at 2 P. M. Election of officers occurs Saturday morning.

During the time of the convention there will also be a SCIENCE EXHIBITION in University Hall at Columbia. The greatest and most comprehensive display yet held is promised of scientific apparatus, materials, methods and books, as well as a large number of non-commercial scientific and research exhibits. This exhibition also "becomes a sort of social center, a place where friends and acquaintances may meet and exchange ideas."

To any one interested in science, which of course includes every reader of EVOLUTION, this convention will certainly be worth a trip across the continent. Tickets may be purchased at nearly all points from Dec. 16 to 26, depending on distance from New York, entitling the holder to half fare on the return trip provided a "Standard Certificate Form" reading for the New York meeting of the "American Association for the Advancement of Science and Associated Societies" is secured at time of purchase. We hope that many readers of EVOLUTION will take advantage of this opportunity to visit New York, and that even during this week replete with science programs they will remember that the latch string is also hanging out at our EVOLUTION office.

IN THE JUNGLES OF TENNESSEE

O, poor old Tennessee,
The original "monkey" state;
It looks like irony,
Like the very hand of fate,

That she, of all the world,
Should be the first to hail
The birth of a baby girl—
With a seven inch simian tail!

Let's all chip in and offer a hundred dollar prize for the longest tail "growed" in Arkansas. I believe she can beat Tennessee by at least two inches.

—*BOB LYLE.*

LET IT BE BOOKS

Don't let the question of what presents to send to your friends give you any more headaches. Stop worrying about it right now, and decide to send books.

There really isn't any more appropriate and acceptable gift. A good book is always welcome. And it has an influence altogether out of proportion to production costs and price. The reading of one good book may transform an entire life.

The reading of a book of the kind listed below opens a new window in the mind. It lets in light, and forever after enables the reader to look out and see and understand more of the world. Thus, when you present such a book to a friend you benefit both him and yourself. Its reading will enable him to live a larger mental life, and it will make him a more interesting companion to you.

And remember that, no matter how "well read" you are, this also holds true for you. So please don't stop with your friends, but make yourself a present too. Certainly, LET IT BE BOOKS.

In addition to the titles listed below, we will be glad to send you any book in print at the publisher's price.

EVOLUTION BOOK SERVICE
96 FIFTH AVE., NEW YORK, N. Y.
Send the items checked to undersigned:

THIS PUZZLING PLANET: Edwin Tenney Brewster	$4.00
A B C OF EVOLUTION: Joseph Mc Cabe	1.75
GROWING UP: Karl de Schweinitz	1.75
HEIR OF ALL THE AGES McKechnie:	3.50
PICTURE BOOK OF EVOLUTION: Dennis Hird	3.75
CREATION BY EVOLUTION: Edited by Frances Mason	5.00
THE BRAIN FROM APE TO MAN: Frederick Tilney	25.00
LET FREEDOM RING: Arthur Garfield Hays	2.50
EVOLUTION FOR JOHN DOE: Ward	3.50
EXPLORING THE UNIVERSE: Henshaw Ward	3.50
DARWIN, THE MAN AND HIS WARFARE: Henshaw Ward	5.00
WAR ON MODERN SCIENCE: Maynard Shipley	3.00
MY HERESY: Bishop Wm. M. Brown	2.00
CONCERNING MAN'S ORIGIN: Sir Arthur Keith	2.00
HISTORY OF WARFARE OF SCIENCE WITH THEOLOGY White (2 vols.)	6.00
OUTLINE OF MAN'S KNOWLEDGE: Clement Wood	5.00
SCIENCE VS. DOGMA: C. T. Sprading	1.50
MICROBE HUNTERS: Paul de Kruif	3.50
WHY WE BEHAVE LIKE HUMAN BEINGS: George A. Dorsey	3.50
ORIGIN OF SPECIES: Darwin	1.00
MAN'S PLACE IN NATURE Huxley	1.00
CREATION: NON-EVOLUTIONARY THEORIES: Brewster	3.50
RIDDLE OF THE UNIVERSE: Haeckel	2.50
THE BIBLE UNMASKED: Joseph Lewis	1.15
THE STORY OF THE INQUISITION	3.20
EVOLUTION: Monthly, One Year	1.00

(Write VERY plainly)

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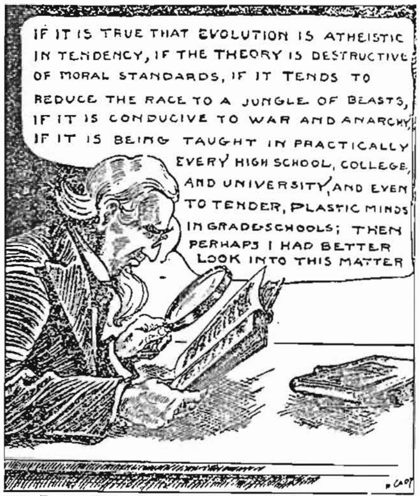
FUNNYMENTALS

"Before the animals were made to pass before Adam to be named, God determined to make another being like him, because He knew that none of the animals were fitted by creation and nature to be his real companions. *They* were simply animals; *He* was a rational human personality constituting a genus all his own. Then the animals passed before him, and he gave them appropriate names. "But for man himself," the translator aptly puts it, "no helper was found who was like him." So God made another personal being of the same genus from the original generic human stock, thus performing at the same time two great crucial biologic acts,—the preservation of the unity of the human race and the differentiation of sex.

"And this, we maintain, as we have often done before, is the most rational and scientific way of accounting for the origin of *genus homo*," Professor Leander S. Keyser, D. D., in Bible Champion, Dec. 1928.


IF IT IS TRUE THAT EVOLUTION IS ATHEISTIC IN TENDENCY, IF THE THEORY IS DESTRUCTIVE OF MORAL STANDARDS, IF IT TENDS TO REDUCE THE RACE TO A JUNGLE OF BEASTS, IF IT IS CONDUCIVE TO WAR AND ANARCHY, IF IT IS BEING TAUGHT IN PRACTICALLY EVERY HIGH SCHOOL, COLLEGE, AND UNIVERSITY, AND EVEN TO TENDER, PLASTIC MINDS IN GRADE-SCHOOLS; THEN PERHAPS I HAD BETTER LOOK INTO THIS MATTER

From Defender (fundamentalist), *Oct.* 28

"The theory of evolution, taught in public schools, is diametrically opposed to the teachings of the word of God, and leads the student to the conclusion that the bible is a book of lies and is utterly undependable, or that the school books are wrong. Teachers are considered by the average scholar almost as infallible as God.

"It is the same as placing a den of rattle snakes in a room with the children. One could not blame a parent for protecting them against a rattler. Can one forbid them from making a stand against this rattler? One kills the body, the other kills the soul. It is to be wondered that parents are able to sit at home as long as they have and know that those things are taught to their little ones." Aimee Semple McPherson, quoted by Chicago Daily Tribune, Oct. 26, 1928.

THE TRUTH SEEKER
National Freethought Weekly
Established 1873
GEORGE E. MCDONALD, Editor
Three months, $1. Foreign, $1.15
49 Vesey Street, New York

FROM OUR READERS

"I've reached the conclusion that Arkansas isn't the only state where anti-evolutionists reside. Illinois has a few also. Proof: One of the above saw my EVOLUTION magazine last month before I saw it, became quite angry at such "heathenish stuff" and flung my magazine into the blazing destructive flames of an old heater.—Amelia A. Kroepel, Illinois.

"As one of the members of Rationalist Press Association I received with great pleasure the distributed copy of your splendid propaganda paper EVOLUTION. It is a first class production which I should wish heartily will have a wide sale on this side as well as in U. S. A. The attitude of the British Press to the famous Tennessee case, by inference suggested that everybody accepted evolution here. This is not so. It is astounding how the average Englishman either completely ignores the subject, or is a bigoted opposer of it. There has been no famous legal test here; the fact remains that Darwinism is NOT taught in our State elementary schools, and very meagerly taught in the best private schools and Colleges. My own children going to public elementary school are taught the origin of Life and the world as per the first chapter of Genesis,—treated literally too. They learn that Charles Darwin was a great naturalist and traveller, who wrote the "Voyage of the Beagle" and was very kind to his family, and that's about all they learn of that.—George Davey, England.

"You are doing very well. Every number of EVOLUTION seems to be an improvement.

"I feel sure that Christian school authorities are directing pupils to take up the dead languages and higher mathematics to the exclusion of the natural sciences with the purpose that they may more easily be led by the churches. Boys and girls are led to study Latin and Trigonometry, who do not know whether their heart is above or below their diaphram; who know nothing of the phases of the moon; who can not analize a flower, and to whom a lump of coal is nothing but a lump of coal.

"I believe this is all done slyly, cunningly, with the purpose of keeping students from studying the sciences that must necessarily lead to knowledge of evolution.

"Enclosed find best wishes and check for fifty dollars, being one per cent of the fund you propose to raise. Yours for Humanity,—M. Mark, Indiana.

FREETHINKERS OF AMERICA
National Headquarters, 5 Columbus Circle. Columbus 7284. Public Meeting, Sunday, Jan. 6th, Rumford Hall, 50 E. 41 St., 3 P.M. At this meeting,
Mr. Philip G. Peabody
champion world trotter, will deliver an address on "His Observations of Forty Years Freethought Throughout the World."— Admission Free.

ATTRACTIVE XMAS PRESENT
Velvet hand-corded Envelope Bag
In any color, 9 x 6 inches, Cute fur dog in corner (Chow, Hardley or Scotch Terrier)—$5.00 by mail
Money back if not satisfied in 10 days
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Food for every meal and for every ailing person—has stood the public test 29 years. Tyler's Macerated (whole) Wheat Combination—fruit, nuts, etc. (no drugs)—tasty, ready to eat—banishes constipation at once, restoring normal health and strength. Incomparable for women in delicate condition. Send dollar or check for week's supply on a money-back guarantee. BYRON TYLER (Established 1899), 1920 Gibraltar Bildg., Kansas City, Mo.

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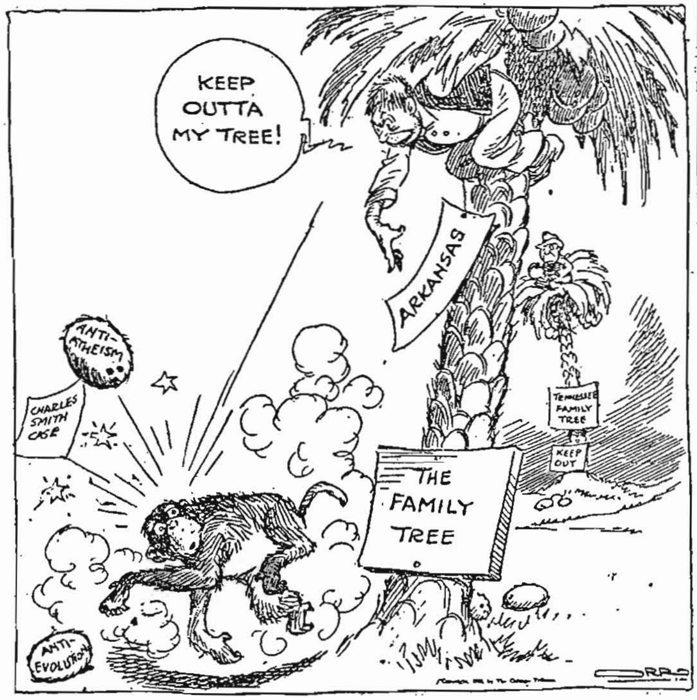
stands for the principles proclaimed in the Nine Demands for Liberalism or the complete separation of church and state. Organized 1876. Incorporated 1900 under the laws of Illinois. A representative national organization managed by a board of directors elected by the membership every third year. Annual membership, $1.00; Life $10.00. Address all communications to W. L. Maclaskey, Secretary, P. O. Box 1109, Chicago, Illinois.

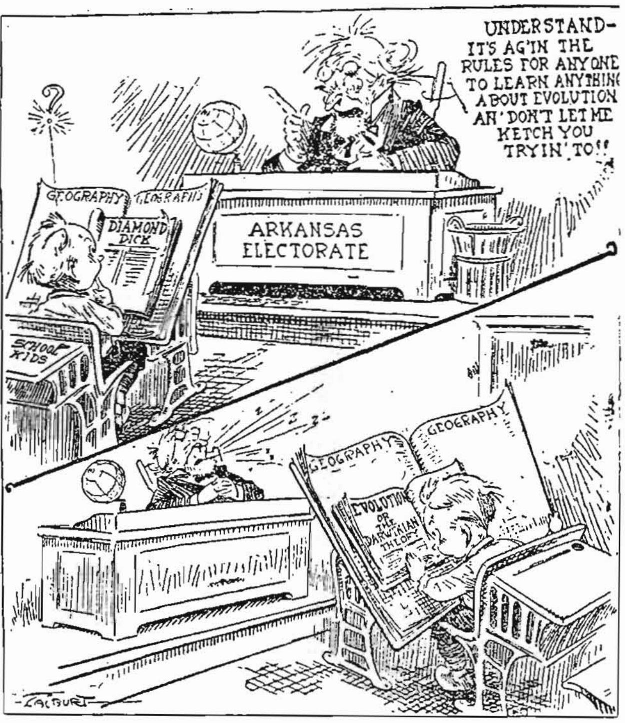
ATHEIST TRACTS FREE
"GODLESS EVOLUTION" AND "THE BIBLE IN THE BALANCE"
Write:
American Association for the Advancement of Atheism, Inc.
119 E. 14th St., New York, N. Y.

In The Off Years Wise Men Provide for Times of Stress
Only 9 legislatures met in 1928; 43 will meet in 1929, and many of them will have anti-evolution measures presented before them.
Fundamentalists are planning their campaign: why not evolutionists?
Join the Science League of America now. Help build up its strength. We need your help NOW, that we may not be caught unprepared to defend freedom of teaching and research when the Big Fight starts again in 1929.
Dues $3 a year; life membership $25.
Write for Leaflet and Application Blank.
Science League of America
Incorporated
504 Gillette Bldg., San Francisco, Cal.

From Various Angles



ANOTHER FAMILY ROW
From Chicago Tribune, Dec. 1.


UNDERSTAND— IT'S AG'IN THE RULES FOR ANYONE TO LEARN ANYTHING ABOUT EVOLUTION AN' DON'T LET ME KETCH YOU TRYIN' TO!!
GEOGRAPHY
GEOGRAPHY
DIAMOND DICK
ARKANSAS ELECTORATE
SCHOOL KIDS
GEOGRAPHY
GEOGRAPHY
EVOLUTION OR THE DARWINIAN THEORY
CALBURT

FORBIDDEN FRUIT
From Cleveland Press, Nov. 15

ENFORCE IT, BY ALL MEANS

Some public officials in Arkansas are reported to have let the idea get abroad that the newly adopted anti-evolution law would be allowed to become a "dead letter." Not so the Superintendent of Public Instruction. He will enforce it up to the hilt. Which moves one of our readers, Bob Lyle of Biloxi, to take his pen in hand as follows:

Biloxi, Miss., Nov. 16th, 1928.

Mr. J. P. Womack, State Supt.,
Little Rock, Ark.

Dear Sir:—

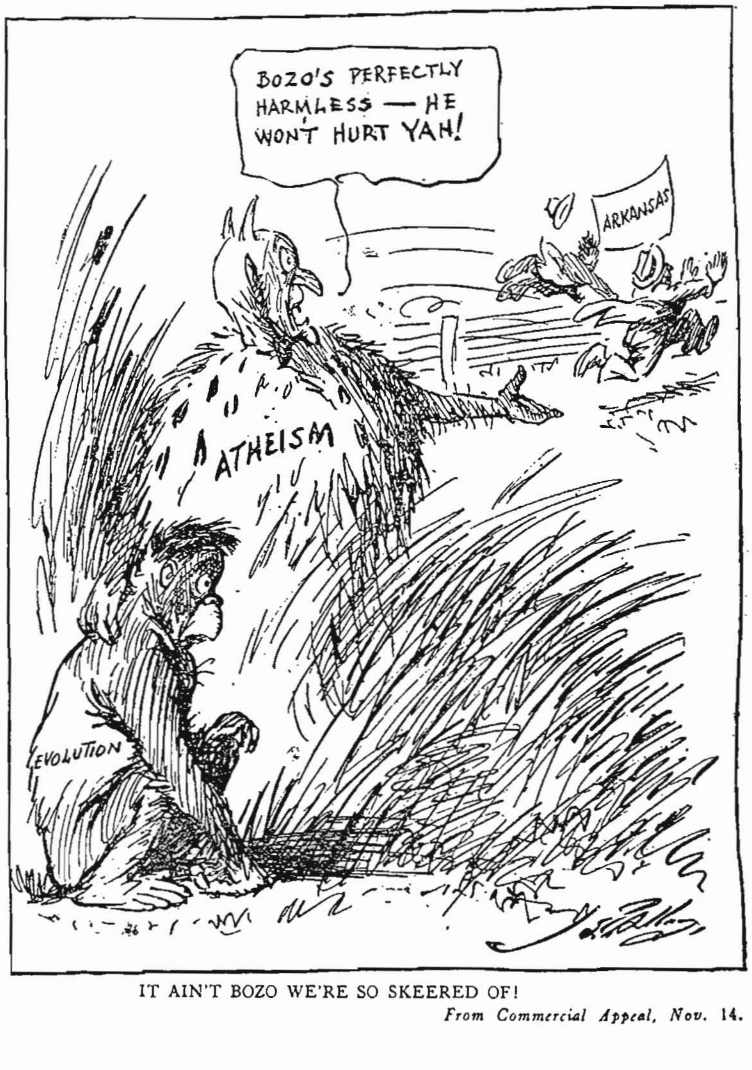
I want to congratulate you on the manly stand that you have taken, regarding the strict enforcement of the recently passed Anti-Evolution law.

These religious laws that Fundamentalists are having enacted are making us a nation of bootleggers and sneaks. An anti-evolution law makes Fundamentalism the state religion, which is unconstitutional. Not only that, it is a personal insult to every teacher.

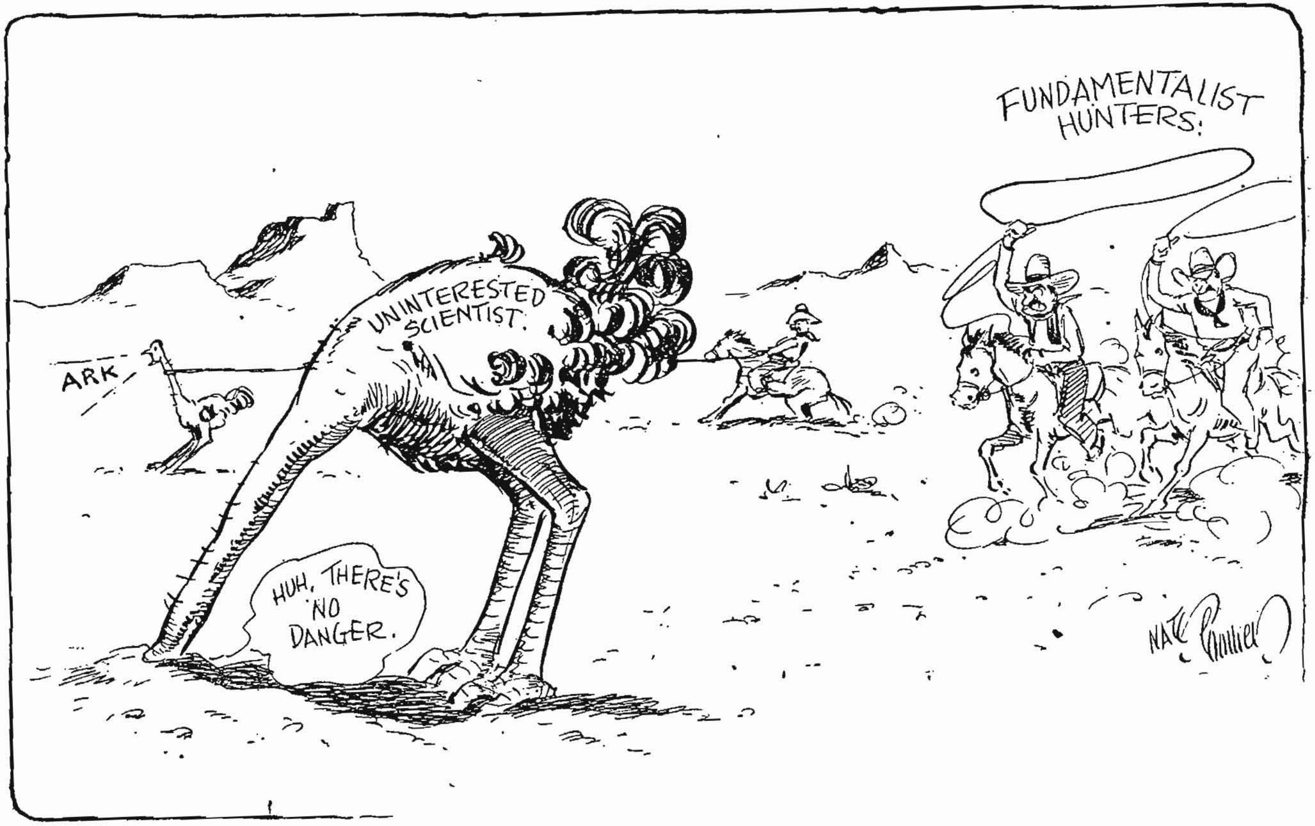
Teachers spend years in preparing themselves for their profession, just as the captain of an ocean liner spends years in the study of navigation. Can you imagine any ship captain who would meekly submit to having his crew and steerage passengers put it to a vote, then demand that he throw his compass and charts overboard and steer his ship by the Bible? Then why should people who are as unfitted to teach the higher branches of knowledge as the average steerage passenger is to navigate a ship, be allowed to say what duly licensed teachers shall teach?

I hope that you will stand by your guns and see that this silly law is lived up to, to the very letter. No teacher can take the proper pride in his profession when obliged to stultify his reasoning powers, in order to hold his job. And no teacher can command the respect of his scholars when they know that he is hypocritically dodging the issue by calling evolution by some other name.

Yours sincerely, BOB LYLE.


BOZO'S PERFECTLY HARMLESS — HE WON'T HURT YAH!
ARKANSAS
ATHEISM
EVOLUTION

IT AIN'T BOZO WE'RE SO SKEERED OF!
From Commercial Appeal, Nov. 14.


FUNDAMENTALIST HUNTERS!
UNINTERESTED SCIENTIST.
ARK
HUH, THERE'S NO DANGER.
NATE COLLIER

Will He Wake up in Time?

THE VERY EXISTENCE

of such abysmal ignorance as is evidenced by the adoption of the anti-evolution law in Arkansas is a challenge to every one of scientific training. It is a constant source of danger, for the vote of the least counts as much as the vote of the wisest, and rightly so. This places the

SOCIAL RESPONSIBILITY

on every man of science to pass his information along, not to monopolize what he discovers, but to popularize it and make it common property.

YOU CAN NOT DISSIPATE

the darkness of superstition by pretending that it does not exist, or by assuming an air of superiority, or by finding it unconstitutional. The only way to break the bonds of bigotry is to

SPREAD THE LIGHT OF SCIENCE

In this task EVOLUTION seeks the co-operation of every enlightened man and woman. It hopes to enlist every scientist with a sense of social responsibility and furnishes an effective method for translating this into action. Use this blank.

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